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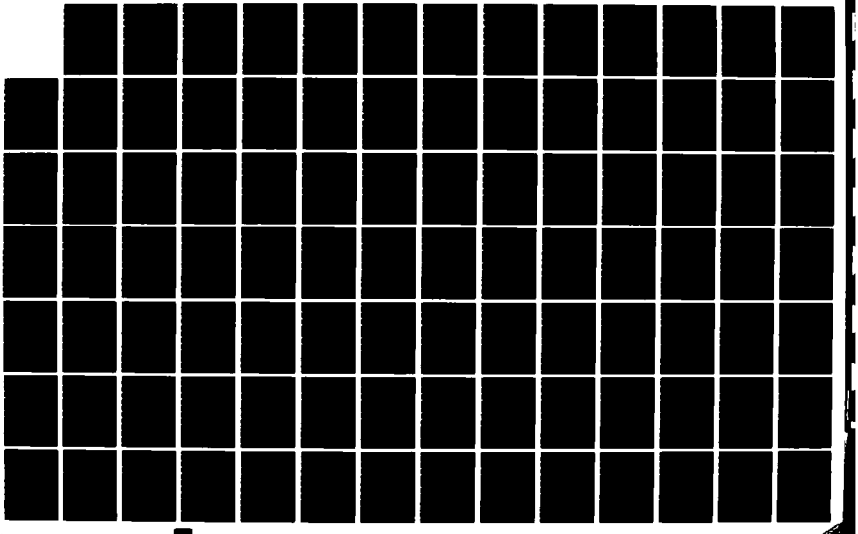

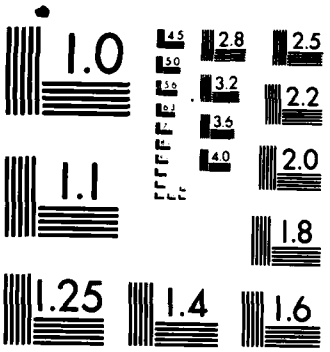

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EVALUATION OF THE AIR FORCE SYSTEMS COMMAND

'RODUCTION RATE MODEL AND ALTERNATE FORMULATIONS

THESIS

Hugh K. Bolton
Captain, USAF

AFIT/GSM/LSQ/85S-3

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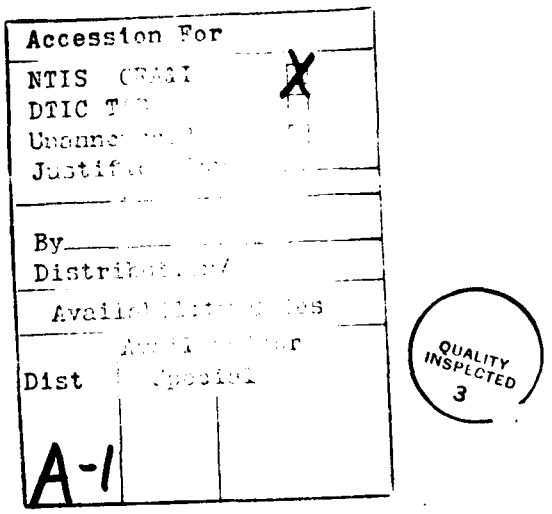

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EVALUATION OF THE AIR FORCE SYSTEMS COMMAND PRODUCTION RATE MODEL AND ALTERNATE FORMULATIONS

THESIS

Presented to the Faculty of the School of Systems and Logistics

of the Air Force Institute of Technology

Air University

In Partial Fulfillment of the

Requirements for the Degree of

Master of Science in Systems Management

Hugh K. Bolton, B.S.

Captain, USAF

September 1985

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Acknowledgments

My involvement with the subject of the cost impact of production rate changes began as a team member for Air Force Systems Command's Affordable Acquisition Approach (A^3) study in 1982. Subsequently, as the manager for the development of the AFSC Production Rate Model, I gained valuable experience working with the production rate issue. This thesis represents the culmination of my work and experience in this area. However, it was only with the help of numerous others that it was possible. I would like to thank a few of them here. First, I would like to thank Headquarters Air Force Systems Command, Directorate of Cost and Management Analysis (HQ AFSC/ACC) for sponsoring this thesis as part of their Cost Analysis Research program, with a special thanks to Captain Thurman Gardner. Thanks also to Mr. Gale Myers, Mr. Lou Kratz and, Ms. Michal Bohn of The Analytic Sciences Corporation (TASC).

I owe a special thanks to my advisor, Mr. Richard L. Murphy. Without his help and insight this thesis would not have been possible.

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Hugh K. Bolton, Captain, USAF

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Abstract

The need to make decisions concerning production rate changes in today's cost conscious environment requires that accurate estimates be made of their impact on cost. The Analytic Sciences Corporation (TASC) developed a model for Air Force Systems Command (AFSC) for this purpose. This model, along with two alternative formulations of the production rate problem is the subject of this investigation.

Based on this analysis it has been determined that the current AFSC model is capable of providing more accurate estimates than the standard unit learning curve model which it is derived from. The first alternative formulation, which includes an additional variable to account for changes in production rate, was shown to consistently provide more accurate estimates than the current model. Since it is based on the current formulation, it can easily be incorporated into the present AFSC model. It is recommended that Systems Command do so. The second formulation, which is based on the unit learning curve model with the exponent expressed as a function of production rate, also provides more accurate estimates than the current formulation though, not as consistently. There is evidence which suggests that this formulation is capable of providing more accurate estimates than the first alternative for certain types of programs. It is recommended that this be further investigated.

EVALUATION OF THE AIR FORCE SYSTEMS COMMAND PRODUCTION RATE MODEL AND ALTERNATE FORMULATIONS

I. Introduction

The intent of this thesis is to evaluate the Air Force Systems Command Production Rate Model, provide recommendations which could improve upon the current formulation, investigate alternate formulations, and provide a basis for determining which alternative will be most useful in helping Systems Command achieve its desired objectives.

General

Program cost growth has been a constant barrier to effectively managing weapon systems acquisitions. In the past, however, it was possible that ineffective cost management could be overshadowed by technical achievement. Today this is much less likely. The public's watchful eye is keenly focused on the Pentagon, and more than ever before, all areas of defense spending are being challenged. With the major cuts social programs have received in recent budgets the public will no longer stand for "fat" in the Department of Defense.

The Department of Defense has been quick to initiate actions in response to congressional pressures to improve cost control. All three services continue to strive for the technical excellence which has become the earmark of United States Defense. Nevertheless, with their budgetary necks being threatened daily with the chopping block, an increasing emphasis is being placed on controlling all phases of weapon systems' costs.

Decision makers within the Department of Defense charged with

controlling weapon systems acquisition costs recognize that producing at more efficient production rates is one way to achieve some measure of cost stability. There is the potential to save billions of dollars and significantly reduce acquisition times as well. Professor of Engineering Management for the Defense Systems Management College, Mr. David Acker, states that "producing a defense system at an economic production rate can provide a financial savings, decrease the production time for the system, and decrease the time to complete deployment of the system" (1:7). This is recognized in a major initiative of DoD's Defense Acquisition Improvement Program which now requires that defense systems be acquired at cost efficient production rates whenever possible (1:6; 7:9).

Unfortunately, there are a number of factors which make buying at cost efficient rates impractical. For instance, Acker states that in some cases "maintaining a 'warm' production line may be more important to our defense industrial base than producing at the economic rate" (1:7). In addition to strategic considerations such as this, there are a number of budgetary and other factors which influence production rate decisions. Annual budget constraints, for example, are often major determinants of program buy schedules. Many times the choice comes down to cutting back on the current year's production quantities for certain programs or completely foregoing other badly needed projects.

Since decision makers are often required to make these trade-offs there is a strong demand in DoD for an analytical tool which can quickly and accurately measure the cost impact of program schedule changes which equate directly to increases or decreases in annual production rates. To this end, Air Force Systems Command contracted with The Analytical

Sciences Corporation (TASC), an independent research and consulting firm in Reading, MA, to develop the AFSC Production Rate Model.

Production Rate Effect

It is fairly well accepted within the Defense Department that varying the rate at which a manufacturer produces a product will have an impact on the per unit cost of that product. Estimates indicate that changes in F-15 production rates accounted for $2 billion of cost growth in FY81 dollars. Stated another way, cost growth associated with program stretch-outs on the F-15 amounted to enough to purchase an additional 400 of the fighter aircraft (16; 7:7). Figure 1, which is derived from actual cost data, graphically displays the effect of production rate on per unit cost for fixed-wing type aircraft.

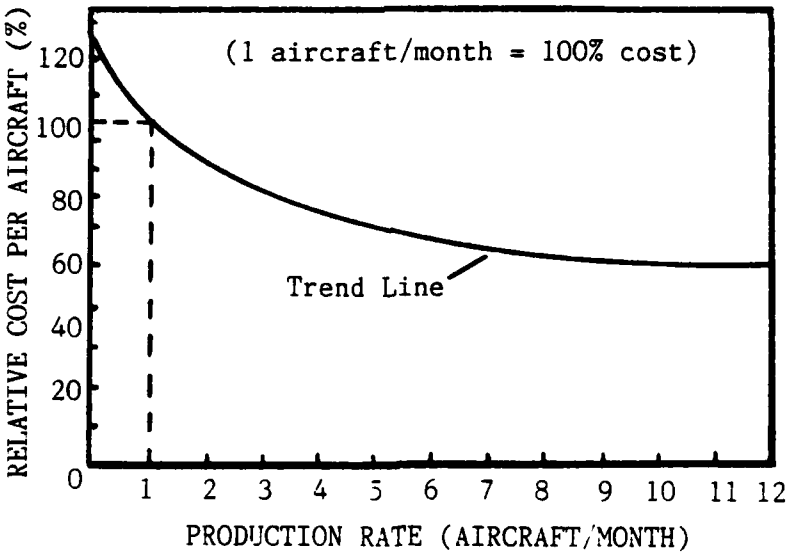


Figure 1. Sensitivity of Fixed-Wing Aircraft Cost to Production Rate (5; 7:7).

It clearly illustrates how costs can decrease (increase) as higher (lower) rates of production are utilized. The Analytic Sciences Corpo-

ration acknowledges this trend as well, but with the addition of a "minimum cost point" beyond which further increases in production rate begin to yield higher per unit costs (6:Sec 3, 9; 2:Sec 1, 4). This idea will be explored further in a later chapter. The actual shape of the curve will vary depending on a number of factors among which are the size of the total production run relative to the capicity of the production facility, the capital intensity of the production facility and, the nature of the item being manufactured. The important thing to remember here is the definite relationship which can be demonstrated between cost and production rate.

The actual impact production rate has on the per unit cost of a weapon system can theoretically be divided into three separate but interrelated effects as seen in figure 2.

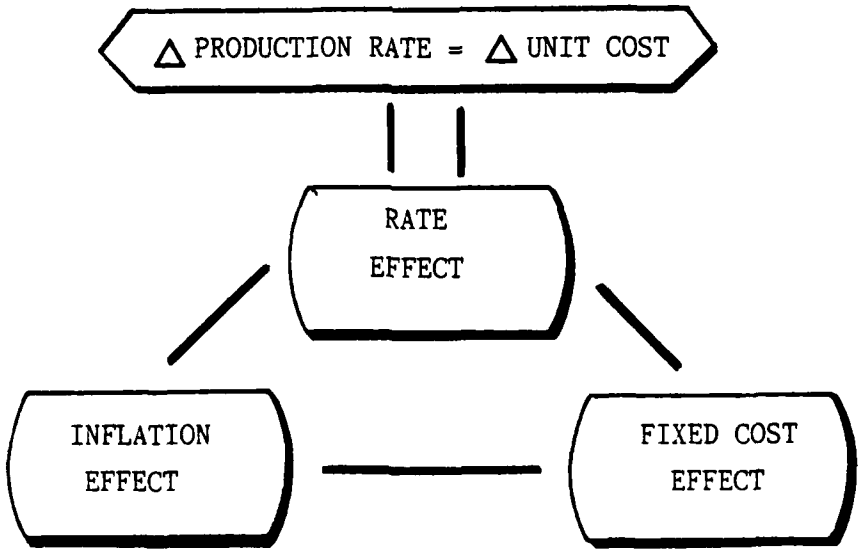


Figure 2. Three ways changes in production rate can cause changes in unit costs.

The first effect is due to instabilities introduced into the

process of learning when the assumption of constant production rate is violated. The theory of learning is discussed further in Chapter 2. In addition to this there is a pure rate effect which is evident because of changes in the utilization of capital. This forms the basis for the "bathtub" shaped cost curve which will be discussed later. Fixed cost effects are present for two reasons. First, varying production rates causes the fixed costs of the production facility to be allocated over a larger or smaller base. Additionally, since total fixed costs are a function of time, rate changes which increase or decrease the number of time periods required to complete production will impact the total fixed costs ultimately allocated to the program. Finally, the effects of inflation are encountered as schedule changes alter funding profiles. Quantities which are shifted to different years are subject to different price levels.

The Model

The Air Force Systems Command Production Rate Model was developed to assess the per unit cost impact of production rate variations as an aid for decision makers. It was intended to provide the basis for rough order comparisons among various production schedules under consideration for a given program. There is some evidence suggesting that when used solely for these so called "what if" type exercizes, within the range of available data the current model will adequately perform this intended function.

Systems Command does not currently intend to use the Production Rate Model as an estimating tool. However, too often numbers quoted during speculative what if exercizes end up being accepted as approved

estimates. This can only serve to compound the problems of controlling cost. With proper validation and statistical testing the model may eventually be accepted for estimating. However, there is some evidence to suggest that the present formulation is not logically sound and there are perhaps other forms which will be better suited to more rigorous requirements. This thesis proposes to address this issue.

Scope and Limitations

This thesis focuses upon evaluating the Air Force Systems Command Production Rate Model as it was formulated by The Analytic Sciences Corporation. References to other efforts which aimed at quantifying the cost impact of production rate variations are made for background purposes and where necessary to support the analysis only. Exclusion of extensive discussions of these other efforts is not intended as a statement of their potential value; that is left for future research. It is intended only as a necessary exclusion to limit the scope of this current effort. Of the three production rate effects previously discussed; learning, fixed cost, and inflation, only learning is addressed in this thesis. The effects of fixed costs are neglected by considering only recurring unit costs in the analysis, and inflationary effects are eliminated by doing the analysis in constant year dollars. Additionally, the model is assessed solely as it applies to defense systems acquisitions; in particular, Air Force systems. Finally, although this thesis assumes no in-depth quantitative background on the part of the reader, a basic understanding of statistical methods is helpful. An explanation of underlying mathematical techniques and formulae is presented only where it is neccessary to aid in a basic understanding of

the analysis. Where appropriate the concepts behind unusual techniques are explained and references to supplementary background material are provided. Data used in this thesis consists of cost and quantity information for 41 Air Force programs, both current and historical, in six categories: (1)bomber aircraft, (2) fighter aircraft, (3) electronics, (4) helicopters, (5) tactical armaments, and (6) tactical missiles. The data set was extracted from the AFSC Production Rate Model Data Handbook, compiled by The Analytic Sciences Corporation from official DoD sources. For a further discussion and listing of the data used in this thesis see Appendix A: Data.

Research Objectives

This thesis centers upon several research objectives as outlined below:

-- The first objective is to evaluate the current (TASC) model formulation and determine if it is capable of producing logically sound and statistically acceptable results with respect to production rate changes.

-- The second research objective is to investigate two alternate formulations to the production rate problem. The first alternative incorporates a measure of production rate change as an additional variable to help explain its impact on unit costs. The second alternative formulation looks at a different model specification which allows the data to determine the optimal rate of production, something the TASC model will not do.

-- The final objective is to compare the results obtained in meeting the first two objectives and to provide justification for selecting one approach to best address the production rate issue.

Summary

Decision makers in the Department of Defense are faced with an increased need to make timely and accurate decisions on matters which

affect weapon system costs. It is accepted that program schedule perturbations with the associated fluctuations in production rates will impact the per unit cost of a system. In order to make intelligent trade-offs between producing at cost efficient production rates and outside budgetary and political considerations they require a tool which can assess the cost impact of production rate changes. A model currently exists within Air Force Systems Command which proports to be able to do this. However, the current formulation of this model may not consistently provide logical and acceptable estimates. There may be alternate formulations which could do better. This is the subject of this investigation.

II. Background

Review of the pertinent literature reveals that previous research in the area of production rate changes centers almost exclusively on the theory of learning curves. The current Air Force Systems Command Production Rate Model is itself based upon this concept. The actual formulation The Analytic Sciences Corporation uses in the AFSC model has been investigated by a number of other researchers. The critical difference between these other efforts and the TASC model is not in the formulation itself but in the approach used to fit the curve to the data.

This chapter provides a brief discussion of the theory of learning curves as it applies to the production rate problem, and then focuses on some of the various works which have contributed to the evolution of the TASC formulation. Chapter three then discusses TASC's formulation of the production rate model and provides a brief description of the TASC curve fitting approach.

The Learning Curve

The theory of learning is one of the most widely accepted ideas in the field of cost analysis. First proposed in 1936 by T. P. Wright, the learning curve is based on the premise that the resource requirements for a specified task decrease with consecutive repititions of the task (19:122-128). Two basic formulations of this theory have emerged over time as standards in the aerospace industry. The unit curve formulation indicates that as the cumulative quantity of an item being produced increases by a fixed percentage, the cost (normally expressed in labor hours) of an individual production unit decreases by some fixed percentage. The cumulative average learning curve formulation on the other

hand assumes that as the cumulative quantity of production increases by a fixed percentage the cumulative average production cost decreases by some fixed percentage. For general purposes the differences between the two formulations are minimal. To aid in the analysis this paper will focus exclusively on the unit curve formulation, which is the formulation used by TASC in developing the AFSC model. The usual presentation of this formulation is provided in equation 1 below:

$$Z = AX^b \tag{1}$$

where

Z = cost of unit X
A = cost of the first unit produced (constant)
X = cumulative quantity
b = learning curve parameter

In typical applications it has become accepted to express this formulation in terms of a doubling of quantity. The learning curve parameter, b, therefore becomes:

$$b = \ln s / \ln 2 \tag{2}$$

where

s = slope of the learning curve

For example, a unit curve having a learning curve parameter of -0.321928 has a slope of $s = 2^b = 0.80$. This means that unit 2 will cost 80 percent as much as unit 1, that unit 4 will cost 80 percent as much as unit 2, and so forth.

Figure 3 is an example of a typical learning curve. Plotted on an arithmetic scale it is easy to see that normal linear least squares regression would be inappropriate for solving for the parameters A and b

in equation 1.

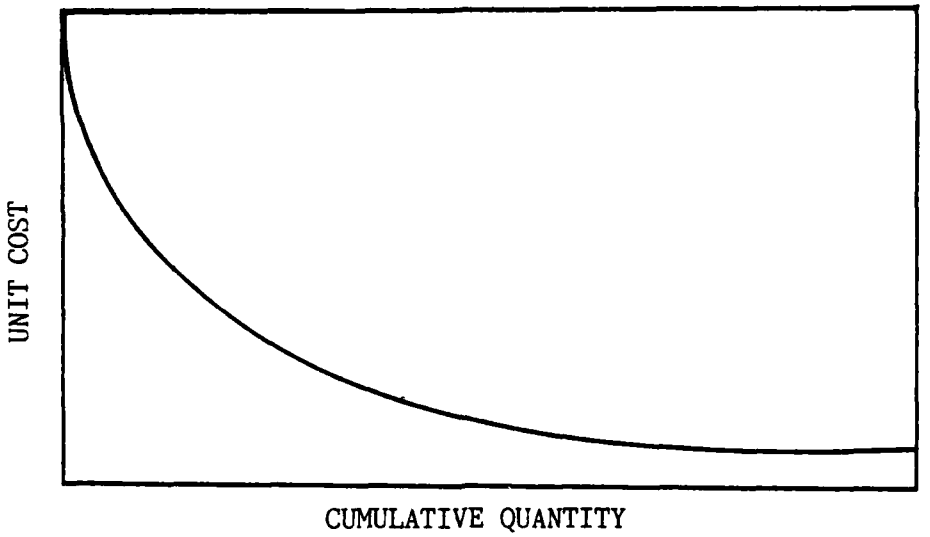


Figure 3. The Learning Curve.

In practice, equation 1 is transformed using a log-linear transformation and normal linear least squares regression is then used to solve for A and b. Equation 3 shows this transformed equation which plots as a straight line on a log-log scale:

$$\ln Z = \ln A + b \ln X \tag{3}$$

Assumptions of this formulation of the cost improvement (learning) curve include among other things, consecutive production, constant production process, constant workforce, and, in general, constant production rate. Since violating any of these assumptions could introduce significant errors into the relationship, and subsequent cost estimates, researchers have attempted to account for such violations. This paper focuses on violations of the constant production rate assumption.

Cost Impact of Production Rate Changes

Review of the pertinent literature indicates that there have been

numerous formulations proposed for assessing the cost impact of production rate changes. As previously noted, the majority of these involve the learning curve concept.

Commander Steve Balut, USN, while a cost analyst with the Office of the Secretary of Defense (Program Analysis and Evaluation), proposed a model which provides an adjustment factor for rate based on those program costs which are not considered fixed in the short term. The model uses a two-step process to adjust for rate changes. The first step invloves the normal application of the learning curve for quantity changes. The second step suggests a hueristic approach based on equation 4 below to adjust for rate changes (3:63-76):

$$F_i = PR(Q_i^{old}/Q_i^{new})^a + (1 - PR) \qquad (4)$$

where

F_i = adjustment factor for lot i (from step one)

Q_i^{old} = old quantity in lot i

Q_i^{new} = new quantity in lot i

P = fraction of price represented by overhead

R = fraction of overhead fixed in the short term

a = rate adjustment slope

Source: (3:66-70).

The factor, F_i, is applied by multiplying the estimates developed in step-one to come up with a new, rate adjusted estimate.

There are a number of limitations to this approach. First, the model is only useful within a small range. Commander Balut himself states that "the model should be applied with caution, and then only within the range of data supporting its development..." (3:75). Second,

the model requires the input of contractor data which is difficult to find and often inconsistent among various contractors. Finally, the model reported in Balut's paper was developed using a non-linear curve fitting approach with only 11 data points. Balut suggests that additional data points could help improve its confidence (3:76).

Another approach was proposed by Dr. Charles Smith, an operation research analyst for the Army Procurement Research Office (13:77-83). Smith's model is also based on the learning curve concept and redistribution of overhead costs. He suggests however, that "the model is based on the premise that costs dependent on time rather than cumulative quantity are the major explainers of the cost impact of rate changes" (13:80). This model is sensitive to changes in variable costs associated with quantity changes via the same mechanism as Balut's model, the learning curve. Smith's model however, then multiplies annual fixed production costs by the number of years the program is in production and adds this to the variable costs. If the program is stretched-out while holding the total quantity constant (thus reducing production rate) then the total amount of fixed costs charged to each production unit will increase accordingly or vice versa. Smith's model is presented in equation 5 below:

$$Y = \frac{\sum_{X=1}^{Q} AX^{b} + T(FC)}{Q} \qquad (5)$$

where

Y = cumulative average cost of production
Q = total quantity produced
A = cost of the first unit produced (constant)
X = cumulative quantity

b = learning curve parameter
T = number of years of production
FC = annual fixed costs for production

Source: (13:81)

The appeal of this approach is its simplicity. Unfortunately, it is limited in that it fails to provide better than a rough order estimate of the effect of rate changes. One reason for this failing is the fact that many costs (for example, depreciation) are only fixed in the short term. Smith feels that the model can be modified to overcome this limitation but recognizes that this would involve the difficult task of estimating the annual fluctuations in fixed costs (13:81).

The final production rate formulation discussed in this chapter is one which has been investigated by a number of different researchers including Dr. Larry L. Smith and John C. Bemis (4:84-94; 14; 1:9; 2: Sec 1, 6-7; 6: Sec 3, 13; 9:3; 12:6-7; 5; 8:259). Instead of providing an adjustment for the reallocation of fixed overhead costs, it incorporates a parameter for production rate directly into the learning curve model. (Note that this formulation ignores the effects of inflation and fixed costs because in typical applications parameters are estimated using only recurring costs in constant year dollars.) This formulation is presented below:

$$Z = AX^{b}Y^{c} \tag{6}$$

where

Z = cost of unit X
A = cost of the first unit (constant)
X = cumulative quantity
b = learning curve parameter
Y = production rate
c = production rate parameter

A graphic representation of equation 6 is given in figure 4.

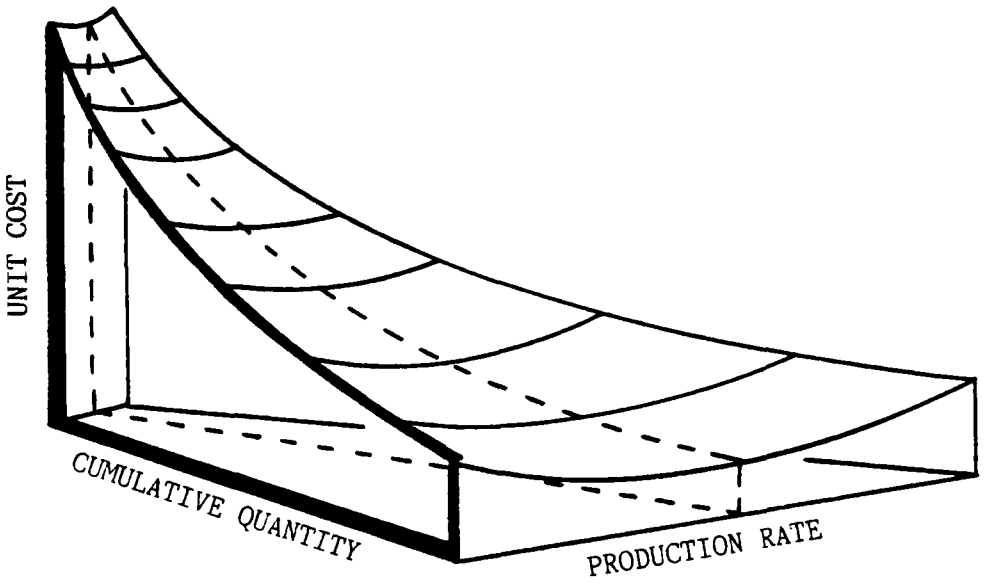


Figure 4. Graphic Representation of the $Z = AX^bY^c$ Production Rate Formulation (1:9; 2: Sec 1, 6; 4:86; 6: Sec 3, 12; 9:3; 8:259).

The darkened lines in the figure represent the basic learning curve model, $Z = AX^b$. The remainder of the figure represents the incorporation of the production rate parameter.

The appeal of this formulation is two-fold. First, once the parameters have been estimated, it requires very little information to use the model. The only thing it requires which the standard learning curve formulation does not is a production rate and it is convenient to use readily available annual buy schedules as a proxy for this. Second, it builds directly upon an already well established model, the learning curve. Extensive use of the learning curve model throughout the Department of Defense can help provide a general acceptance of this production rate formulation both within the cost analysis community and within the decision making bodies which approve their estimates. Additionally, using log-linear transformations the model's parameters, A, b, and c,

can be estimated using linear least squares regression just as is done for the simple learning curve formulation. The linearized equation is presented below:

$$\ln Z = \ln A + b\ln X + c\ln Y \tag{7}$$

Unfortunately, there are several problems associated with using a linear approach to solve this formulation. First, there is a problem of collinearity between the model's predictor variables, X and Y. Several researchers, including Bemis and TASC, have identified this limitation of the data (4:93; 6: Sec 4, 2-4). The presence of this condition basically means that each variable is explaining part of the variation in the data associated with the other thus making it impossible to separate the effects of quantity changes (learning) from the effects of production rate changes.

The next major limitation of the linear approach used by Bemis and others is that error associated with using estimated lot plot points is introduced into the model. Since cost data for most major programs is readily available only by production lot and not by individual unit, it is necessary to enter data in the form of average unit cost per lot and to estimate a lot plot point as a coordinate value. Inasmuch as the actual unit costs within a lot are not uniform (That is, they decrease at a decreasing rate because of learning.) the true lot plot point will not lie in the center of a given lot.

For example, suppose that a lot of 10 units has a total lot cost of $1,000. Various senarios could apply. If the lot is completely uniform then each unit will cost exactly $100 and the lot plot point would be 5. Now, suppose that the cost of unit 1 is some value greater than $100 and

that the value of successive units decreased at a constant rate such that the sum of the ten units was still $1,000. In this case the average unit cost of the ten units would be $100 and the plot point would still be 5. Finally, suppose that the cost of unit 1 were some value and that the values of successive units decreased logarithmically (as with the learning curve) such that the total lot cost was again $1,000. In this final case the average unit cost for the ten units is still $100 but, the lot plot point would lie somewhere to the left of 5. The position of the true lot plot point is a function of the slope of the learning curve. The steeper (flatter) the slope, the farther left (right) the point will lie.

In general, rules of thumb are used to provide estimated lot plot points for evaluating learning curves. The error associated with these plot point estimates consequently introduces bias when solving for the parameters in equation 6.

Finally, several researchers, including Sherbrooke and Associates, in a critique of various aquisition models, have suggested that a direct non-linear method will provide a better fit of the data while perhaps avoiding some of the statistical problems inherent in the linear approach (12:50).

The approach used by TASC in developing the AFSC Production Rate Model is direct non-linear. Chapter three discusses their method in detail.

III. The TASC Approach

The AFSC Production Rate Model is based upon the the formula introduced in chapter two, equation 6. The key difference between previous efforts and TASC's work is that TASC uses a direct non-linear method for solving for the parameters, A, b, and c. For convenience, equation 6 is presented again below:

$$Z = AX^{b}Y^{c} \tag{6}$$

where

Z = cost of unit X
A = cost of the first unit (constant)
X = cumulative quantity
b = learning curve parameter
Y = production rate
c = production rate parameter

TASC assumes that the response curve of cost to production rate is "bathtub" shaped as shown by the long-run cost curve in figure 5 below:

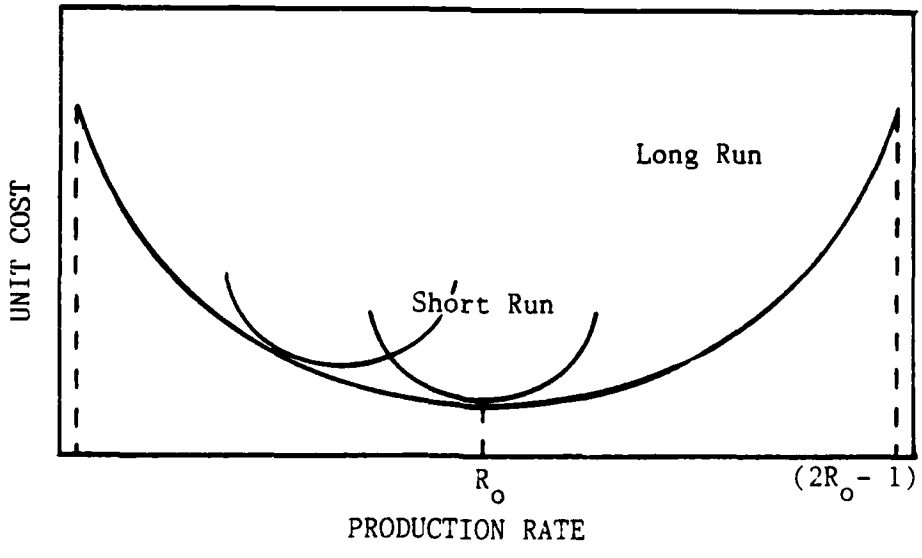


Figure 5. TASC's "Bathtub" shaped average cost curve (6: Sec 3, 9).

The long run cost curve assumes all inputs can vary. Its shape reflects the inefficiencies associated with very small or very large operations. The short run cost curve assumes that plant and equipment are fixed. Its shape reflects the inefficiencies associated with under or over utilization of capital. Both curves have a minimum (R_o), and both are relatively flat in the center, so that small changes in rate around R_o have little effect on cost. However, the R_o for a specific short run cost curve may differ from the R_o for the the long run curve.

TASC assumes that the curve is symmetric about R_o. This assumption implies that a percentage increase in production rate above R_o will yield the same per unit cost impact as a like percentage decrease in production rate below R_o. Since the formulation given in equation 6 cannot account for this, the variable Y (production rate), is expressed as shown below:

$$Y = \begin{cases} R \text{ if } R \leq R_o \\ 2R_o - R \text{ if } R_o < R \leq 2R_o - 1 \end{cases} \qquad (8)$$

where

Y = production rate
R = production rate for a given lot
R_o = minimum cost production rate

Source: (6: Sec 3, 13)

This function transforms production rates greater than R_o into equivalent rates between 1 and R_o. The constraint, $R \leq 2R_o - 1$, recognizes that rates greater than $2R_o$ would give Y values of less than 1.

Fitting The Curve

To solve equation 6 for A, b, and c TASC first estimates the total

cost for each lot by integrating over the total number of units for each lot as shown in equation 9 at the top of the next page.

$$TC_i' = \int_{Xl_i}^{Xu_i} AX^b Y_i^c \, dX = [A/(b+1)][Xu_i^{(b+1)} - Xl_i^{(b+1)}][Y_i^c] \qquad (9)$$

where

TC_i' = estimated total cost of lot i

Y_i = production rate for lot i

Xl_i = cumulative quantity through lot i-1

Xu_i = cumulative quantity through lot i

A = constant

b = learning curve parameter

c = production rate parameter

Source: (6: Sec 4, 6).

Actual total lot costs are then found by multiplying actual lot quantity (known) by the average unit cost for the lot (known). Actual total lot cost for each lot, i, is denoted TC_i.

Finally, the unknown parameters A, b, and c are solved for by minimizing the sum of squared errors between TC_i and TC_i' as shown in equation 10 below:

$$\sum_{i=1}^{N} w_i[TC_i - TC_i']^2 \qquad (10)$$

where

N = total number of lots
w_i = weight of lot i (where $\sum w_i = 1$)

The weights, w_i are determined by the user and reflect the relative importance of each lot (6: Sec 4, 6). Normal learning curve estimation assigns equal weights to all lots. Some models on the other hand weight each lot based upon the size of the lot relative to the total quantity as shown below:

$$w_i = [\text{quantity in lot i}]/[\text{total quantity}]$$

The method used by TASC allows the model user to specify the weighting scheme to be used for each program. It is assumed that TASC uses equal weighting for all lots in their work for Systems Command. However, this was not reflected in the available documentation and therefore cannot be stated with certainty.

The technique actually used by TASC to minimize equation 10 is Newton's Method and invloves an iterative solution to the matrix of non-linear equations gained through partial differentiation of equation 10 with respect to parameters A, b, and c. Because of the complexity of Newton's Method a discussion of it is not included in this section of the thesis. For a further discussion of the technique refer to Appendix B: Newton's Method.

IV. Methodology

This chapter outlines the methodology used to meet the research objectives which were first discussed in chapter one. For convenience each objective will be repeated at the beginning of its corresponding section in this chapter.

Evaluating The TASC Model

— The first objective is to evaluate the current (TASC) model formulation and determine if it is capable of producing logically sound and statistically acceptable results with respect to production rate changes.

SAS/TRAC Comparisons. When TASC developed The Air Force Systems Command Production Rate Model they did not provide their proprietary curve fitting program, TRAC (TASC Rate Analysis Curve). Instead, they provided a program written for the Statistical Analysis System (SAS) which could be used by Systems Command to replicate TASC's results and for fitting the curve to future programs. For a listing of the SAS program and description of the program steps see Appendix C: SAS Programs.

The first step before analyzing the Systems Command model is to determine if the SAS program is indeed capable of replicating TASC's work. To accomplish this, parameters will be estimated for each of the 41 data sets using the SAS program and the results will be compared to those estimated using TRAC. Because of the proprietary nature of the TRAC curve fitting routine it is likley that the SAS program will not provide an exact replication of the parameters TASC predicted. Therefore, if each of the three parameters predicted by SAS for a program are

within ten percent of the corresponding parameters predicted by TASC this will be considered adequate replication for that particular program. If at least 75 percent (thirty) of the 41 programs meet this criteria it will be concluded that the SAS program adequately replicates TASC's results. The following simple equations will be used for the comparison:

For a given program,

$$\text{if } \left|(A_{TRAC} - A_{SAS})/A_{TRAC}\right| \leq 0.1$$

and

$$\text{if } \left|(b_{TRAC} - b_{SAS})/b_{TRAC}\right| \leq 0.1$$

and

$$\text{if } \left|(c_{TRAC} - c_{SAS})/c_{TRAC}\right| \leq 0.1$$

then: Conclude that SAS = TRAC for that particular program.

Residuals: Learning vs. Production Rate Models. The next step in evaluating the TASC formulation is to determine if the model is providing a more accurate estimate of cost than the standard learning curve model is capable of providing. The basic premise behind including the rate parameter in TASC's model is that the learning curve model is misspecified and that the inclusion of rate as an independent variable accounts for a significant proportion of the variation in the data. To test this premise, costs are estimated using a standard learning curve model and the residuals are compared to to the model which includes the production rate variable. Residuals are the differences between the actual values and the values predicted by the model.

Step 1. Calculate the sum of the squared residuals for each of the 41 programs for each formulation. Squaring accounts for the fact that

the residuals can be either positive or negative and would otherwise cancel each other out.

Step 2. If the value for the TASC formulation is less than the value for the standard learning curve model by 10 percent or more then conclude that the production rate formulation explains a significant portion of the variation in the data that is not explained by the standard learning curve model. If the value for the production rate formulation is greater than the learning model for a particular program this indicates that the addition of the rate variable actually made the estimate worse for some reason.

This test is done on a program by program basis. It is expected that programs with stable rates of production will show results similar to those achieved with the normal learning curve model. This is because as the parameter c approaches the value of zero (as it would with stable production rates) the production rate term goes to unity and the model reverts back to the standard learning curve formulation. On the other hand, programs with the largest shifts in rate should show a significant improvement by including the production rate term.

The learning curve model which is used in this analysis is ICLOT and was chosen for several reasons. First, it was readily available and is widely used and accepted in the cost analysis community. Second, it uses an iterative process to determine lot plot points similar to what is done in the TASC approach through Newton's method. This minimizes the amount of error which could be contributed to lot plot point bias. Finally, it uses the same unit curve formulation which is the basis for TASC's model.

Logic Analysis. In this final step TASC's formulation is analyzed to determine if it is logically sound. In accomplishing this, assumptions TASC makes with respect to the production rate model and assumptions of the non-linear curve fitting approach are evaluated for

validity and impact. For instance, the non-linear curve fitting technique requires that the production rate be held constant for each lot. Since annual buy schedules are being used as a proxy for production rate is this a valid assumption, and if not, to what extent does violation of this assumption invalidate the model? The key to this section is in insuring that the model is not merely providing a good fit of the data, but is logically capable of providing acceptable estimates within the range of production rate data. It is characteristic of learning curves that cost estimates are always for quantities which lie beyond the range of historical data. However, learning curves have progressed to the stage where the theory underlying the phenomena has been well defined, empirically tested, and found to be sound. Confidence in this theory allows projection beyond the range of the data with reasonable confidence in the outcome. Since the impact of production rate on unit costs is yet to be adequately defined and empirically verified, care needs to be taken when applying any production rate model. This area offers great opportunities for future research.

Evaluating Alternate Formulations

— The Second research objective is to investigate two alternate formulations to the production rate problem. The first alternative incorporates a measure of production rate change as an additional variable to help explain its impact on unit costs. The second alternative formulation looks at a different model specification which allows the data to determine the optimal rate of production, something the TASC model will not do.

Logic Analysis. The first step in evaluating the two alternate formulations will be to analyze the logic behind their selection. Both

models are based on the unit learning curve formulation just as the TASC formulation is.

The idea behind alternative one is that the change in production rate from one lot to the next is as important in explaining the impact of production rate on cost as is the rate itself. Moving from a higher rate of production to a lower rate, or from a low rate to a higher rate, would have an impact on the efficiency of the production process which would not be captured by looking at production rate alone. To account for this a new variable, R, was added to the TASC formulation. R is defined as the ratio of the production rate in the current lot to the rate in the previous lot. The formulation of alternative one is shown below:

$$Z = AX^{b}Y^{c}R^{d} \tag{11}$$

where

Z = cost of unit X
A = constant
X = cumulative quantity
b = learning curve parameter
Y = production rate
c = production rate parameter
R = ratio of the rate in lot i to the rate in lot i-1
d = production rate change parameter

The second alternative is formulated to model the bathtub shaped production rate curve mathematically. To do this it uses the standard unit curve model with the exponent expressed as a function of Y, production rate. A quadratic function was selected since it best models the expected shape of the production rate curve with a minimal number of additional parameters. Alternative two is shown at the top of the following page.

$$Z = AX^{(b+cY+dY^2)} \tag{12}$$

where

Z = cost of unit X
X = cumulative quantity
Y = production rate
A,b,c,d = model parameters

So long as c<0 and d>0, this formulation will produce an optimum production rate, R_o, at which unit costs will decline along the steepest possible learning curve slope. If the production rate deviates from R_o in either direction, the slope of the learning curve becomes less steep, which means a slower rate of learning. This formulation is consistent with the expected response pictured in figure 4.

Asymptotic Confidence Intervals. In addition to its other output the SAS NLIN procedure provides a 95% confidence interval estimates for the coefficients. If an interval estimate for a particular coefficient bounds zero then the hypothesis is accepted that the true parameter is equal to zero and not significant at the 95% confidence level. These confidence intervals will be analyzed to determine if the parameters included in the two alternate formulations are significant. However, it is probably unreasonable to demand that this hypothesis be tested at such a high level of confidence. It increases the probability of accepting the hypothesis when it is false. Therefore, coefficients which fail the 95% test of significance will be reevaluated at the 80% level if it appears that lowering the level of confidence could change the outcome of the test. A 95% confidence interval estimate that appears to be nearly symmetrical around zero would undoubtedly still include zero even if the level of confidence were reduced to 80%.

Comparing Approaches

— The final objective is to compare the results obtained in meeting the first two objectives and to provide justification for selecting one approach to best address the production rate issue.

Residuals. This step is a repeat of the analysis performed in comparing the TASC model to the standard learning curve model. The sum of squared residuals for the TASC model and the two alternatives will be compared on a program by program basis. The goal is to identify the model which consistently provides the more accurate estimate over a wide range of programs.

Based upon this evaluation and the discussion in the previous two sections, the three alternatives (the TASC model and two proposed alternatives) will be compared. If one alternative is an obvious standout, that is, consistently provides improvements in the sum of squared residuals over the other two formulations, then the results of the analysis will be conclusive in favor of that formulation. If, however, the evaluation indicates that two formulations are equally capable of providing consistent improvements then the results will be conclusive in favor of that model which is more logically supportable. Finally, if none of the three formulations is capable of providing logically sound and statistically acceptable results it will be concluded that Systems Command should continue using their present model until a better one can be developed.

V. Analysis

This chapter presents the results of the analysis which was performed on the current Air Force Systems Command Production Rate Model as developed by The Analytic Sciences Corporation (TASC) and the two proposed alternatives.

The TASC Model

This section discusses the current production rate model. The formulation of this model, which was discussed in chapter three, is found in equation 9. It is repeated below for reference:

$$TC_i' = \int_{Xl_i}^{Xu_i} AX^b Y_i^c \, dX = [a/(b+1)][Xu_i^{(b+1)} - Xl_i^{(b+1)}][Y_i^c] \qquad (9)$$

where

TC_i' = estimated total cost of lot i

Y_i = production rate for lot i (constant for a given lot)

Xl_i = cumulative quantity through lot i-1

Xu_i = cumulative quantity through lot i

A = constant

b = learning curve parameter

c = production rate parameter

Source: (6: Sec 4, 6).

SAS/TRAC Comparisons. The parameters A, b, and c which were estimated by TASC's proprietary curve fitting program (TRAC) can be found in Appendix D, section 3. Those estimated using the SAS routine

which TASC provided to Systems Command are in section 2. The following are the results of the test discussed in the previous chapter:

- Eighteen of the forty-one programs met the ten percent criteria for all three parameters.
- Thirteen programs had one parameter which was beyond the criteria while the other two remained within. All but one of these failed on parameter A.
- Six programs met the criteria on only one parameter. Of these, five met on parameter b and one on c.
- Four programs failed to meet the ten percent criteria on any parameter.

Since less than thirty programs met the criteria for all three parameters it should be concluded that the SAS program provided by TASC does not adequately replicate the parameters estimated using TRAC. There are, however, several considerations which suggest that these results are not reliable. First, the parameters b and c were not compared directly. Instead, the slopes corresponding to the two parameters were compared. (Recall from chapter two that the slope corresponding to the parameter b is 2^b, and likewise for c.) This was done because TASC presented only the slopes corresponding to the parameter values and not the parameters themselves in their report. Furthermore, they reported the slopes only to an accuracy of two decimal places. Because of rounding, the actual value of the parameter can take on a wide range of values. For example, any value from 0.945 through 0.954 will be rounded to a slope of 0.95. The problem presents itself because of the logarithmic relationship between the slope and actual parameter (parameter = ln slope/ln 2). While the difference between 0.945 and 0.954 is only 1%, the corresponding parameter values of -0.0816138 and -0.0679388

yield a difference of 16.8%.

The next problem is that small differences in the estimates of b and c cause large differences in A. This was suspected because of the twelve programs which failed to meet the criteria due to parameter A. For example, suppose that one program fitted the model to a set of data with the result that both parameters corresponded to a slope of 0.95. Given that the first 100 units cost $1000, solving equation 9 for A produces a value of 18.477997. If another program fitted that same model to the same set of data with the result that b corresponded to a slope of 0.95, but c corresponded to a slope of 0.93, A would increase to 21.283764. An increase of only 2.1% in the slope associated with the production rate produced a 15.2% difference in the value of A. If the twelve programs which failed to meet the criteria for parameter A but satisfied the criteria for parameters b and c are considered acceptable, successful replication of SAS by TASC was accomplished for thirty-one of the forty-one programs evaluated (75.6%).

Finally, the output reported by TASC raises some unresolved issues which impact on the ability of SAS to replicate TRAC. For example, the B-58 was one of four programs which failed to meet the ten percent criteria on any of the three parameters. TASC failed to report estimated cost for lots 1, 9, and 10 of this program, even though it is a simple procedure to calculate lot estimates by solving equation 9 once parameters A, b, and c have been estimated. Note that a total of twenty-one programs have one or more lots for which costs were not reported by TASC. The absence of reported estimates for these lots combined with the failure of SAS to replicate TRAC suggests that TASC may have modified the data set before estimating the model parameters.

If this is the case, lack of documentation makes it impossible to determine exactly what data set should be used to evaluate the ability of the SAS program to replicate the reported results.

Because of the problems identified above it was not possible to determine with certainty if SAS is capable in every instance of replicating TRAC. However, TASC recommends using SAS to estimate the parameters of their model. Furthermore, TASC states that the SAS procedure and TRAC are "equivalent" and that TRAC was validated using SAS (17: 30, 34). Therefore, given the above analysis and the assurances offered by TASC, the assumption will be made that, given the same data set, the results generated by SAS can be accepted as a reasonable replication of TRAC's output.

Residuals: Learning vs. Production Rate Models. This section discusses the results of the comparison of the TASC production rate model with the standard learning curve formulation. Since TASC's model simply adds a variable for production rate to the unit learning curve equation it should be determined if this variable improves the estimating ability of the model. The results of the ICLOT learning curve runs can be found in Appendix D, section 1. Results of the SAS runs for the TASC formulation are in section 2. Results for the two formulations were compared by calculating the percentage difference in their sum of squared residuals (SSR) for each program as shown below:

$$[(SSR_{ICLOT} - SSR_{TASC})/SSR_{ICLOT}] \times 100$$

where

SSR_{ICLOT} = sum of squared residuals from the ICLOT model

SSR_{TASC} = sum of squared residuals from the TASC formulation (SAS)

The results of this test are given in table I below and summarized at the top of the following page.

TABLE I

ICLOT versus TASC Residual Comparison Summary

Program	SSR (ICLOT)	SSR (TASC)	Difference (%)
B-1B	28429	12451	56.2
B-52	8515485	2448210	71.2
B-58	705710	483386	31.5
A-10	83457	8904	89.3
F-100	42183	40716	3.5
F-101	28812	23846	17.2
F-102	16903	608	96.4
F-106	76697	47059	38.6
F-15A/B	7558	6603	12.6
F-15C/D	82519	51443	37.7
F-15E	36220	26000	28.2
F-16A/B	142989	85449	40.2
F-16E	522731	347668	33.5
ARC-109V	.11414	.09382	17.8
ARC-54	6.14327	6.61101	-7.6
ASN-63	40.111	32.442	19.1
ASN-70	.02453	.01845	24.8
ASN-99	13.523	4.405	67.4
CP-1035N	1.15902	.90140	22.3
LANTIRN(Nav Pod)	.39939	.04198	89.5
LANTIRN(Target Pod)	.02550	.09890	-287.8
LANTIRN(Target Rec)	1.13954	1.58543	-39.1
ASQ-133	3.43814	3.01541	12.3
ASN-108	.950186	.79522	16.3
ASW-32	6.06409	7.70686	-27.1
JTIDS	.67788	.12319	81.8
HH-52	4.03028	2.94411	27.0
CH-46	8777.4	1218.9	86.1
H-53	300.4	177.4	40.9
CH-47	14163	5154	63.6
H-54	266.1	125.5	52.9
HH-60D	35.323	2.073	94.1
SH-3	426.35	289.99	32.0
LLLGB	7277633	7446217	-2.3
CEM	893775690	647791386	27.5
GBU-15	284882710	148042874	48.0
AMRAAM	1938	1658	14.4
HARM	2435	399	83.6
MAVERICK	8259	3385	59.0
AIM-7F(R)	424	250	41.0
AIM-7F(GD)	173	84.8	50.9

- Thirty-five of the forty-one programs showed a ten percent or greater improvement in residual sum of squares over the standard learning curve model. One showed only slight improvement and five showed an increase in SSR over the ICLOT estimates.
- The average percentage improvement over the learning model for all programs was 32.3% with a standard deviation of 58.8.
- The average percentage improvement for only those 36 programs which showed an improvement was 46.4% with a standard deviation of 26.7.

Based on this evidence it is concluded that the TASC production rate formulation provides a significant improvement over the standard learning curve model. There was some evidence indicating that those programs with stable production rates improved less than those with large shifts in rate. Several programs such as the CH-46 and CH-47 helicopters, had large shifts in rate for one or two periods within otherwise stable production runs. These two programs showed 86.1% and 63.6% decreases in the sum of squared residuals respectively. Conversely, the F-100 had a small lot 1 rate but was stable throughout the remainder of the program (lot sizes for lots 2 through 5 ranged from 545 to 593), and the improvement for this program was only 3.5%. The LLLGB program made a steady build-up and then leveled off at a rate of 15600 units per year for three years. This program actually showed an increase in the residual sum of squares by going to the production rate formulation.

Logic Analysis There are several assumptions TASC makes in developing and analyzing the Systems Command model. Only those which could have a questionable impact on the validity of the model or TASC's results are considered here.

First, application of Newton's Method to the TASC formulation

requires that the production rate (Y_i) be held constant for a given lot i. This is probably a valid assumption if the time periods for each lot are sufficiently small. While it is unlikely that production rates would differ significantly from month to month, it is highly probable that a contractor might implement a substantial change in the rate of production over a period of a year. Consequently, the use of annual buy schedules as a proxy for the production rate could introduce some error into the model. However, because of the difficulty of obtaining accurate cost/quantity data on a monthly basis, it is difficult to assess how much error is being introduced. Furthermore, the decision makers who use the model for "what if" exercizes may only know the projected annual buy quantities. It does no good to build a model which requires inputs which cannot be reasonably estimated at the time the model is to be used.

The next assumtion TASC makes is that the relationship between cost and the production rate is a symmetrical U-shaped curve, frequently refered to as a bathtub curve. The curve implies that an optimal rate of production exists at which unit production costs will be minimized. The assumption itself is probably reasonable. However, the model formulation used by TASC cannot generate the assumed curve. Instead, TASC has provided an algorithm which capitalizes on the hypothesized symmetry of the curve to adjust for those observations for which the rate of production is greater than the optimum (equation 8, chapter 3). The problem is that the optimal rate of production must be determined prior to the fitting of the model. If observations fall on both sides of the optimal production rate, failure to adequately adjust the data will result in distorted parameter estimates.

Next, one of the arguements TASC offers for using the non-linear approach to estimate parameters over the least squares best fit log-linear approach used by previous researchers deals with a "pseudo-R^2". TASC defines the pseudo-R^2 "as the squared correlation between the observed and predicted values of the independent variables" (18: Appendix B, 5). In an analysis of the F-15A/B and HARM programs TASC states that "since the value of the pseudo R^2 for the non-linear model is higher than the R^2 for the linear model, the non-linear model provides a better 'fit' of the data" (18: Appendix B, 5). While the R^2 value for the linear model can provide a suitable measure of "fit," the pseudo-R^2 cannot. It can be shown that this proposed statistical measure can take on any number of values which in no way indicate the fit of the data. For example, suppose the non-linear model had provided the estimates below for two programs, A and B:

	Program A			Program B		
Lot	Actual	Predicted	Percent Difference	Actual	Predicted	Percent Difference
1	54.0	53.6	0.7	56.5	67.9	-20.2
2	54.0	52.3	3.1	50.1	40.8	18.6
3	52.0	53.0	-1.9	43.7	35.0	19.9
4	50.2	53.9	-7.4	38.1	45.7	-19.9
5	48.9	48.5	0.8	32.0	25.6	-20.0

Looking at the percentage differences between the actual and predicted values above it is obvious that the model provided a better fit of program A than of B. However, pseudo-R^2 values for both programs would indicate otherwise. The value for program A is 0.5756 while the value for program B is 0.8086. This is just a mild example of the problems with pseudo-R^2. For this reason the pseudo-R^2 is an invalid measure of fit and should not be used for future analyses.

Finally, TASC discusses asymptotic confidence intervals which are provided by SAS for each parameter. TASC correctly argues that if an interval for a particular parameter does not bound zero then the hypothesis that the parameter is equal to zero (i.e. has no effect) can be rejected at the 95 percent level of confidence. TASC shows that for the HARM program all three parameters are significant at this level. However, according to the SAS results listed in Appendix D, section 2, HARM is one of only four programs which showed all three parameters to be significant at the 95 percent level. Sixteen programs showed only two parameters to be significant at this level, four showed only one, and seventeen programs indicated that none of the parameters were significant at the 95 percent level. TASC does not discuss the results mentioned above. As a check, confidence intervals at the 80% level were calculated to determine if this would increase the number of programs which showed all three parameters statistically significant. Even at this lower confidence level only nine programs met the criteria.

Alternate Formulations

Two alternate formulations were developed to address the production rate issue. Both of these models were compared to the TASC model just discussed. The results for each of these comparisons is presented in the following sections.

Alternative one Alternative one was introduced in the previous chapter in equation 11. Integrating equation 11 with respect to X provides an estimate of total lot costs. Using the SAS NLIN procedure, parameters A, b, c, and d are estimated which minimize the residual sum of squares between actual total lot costs and those predicted by the

model. The result of the integration is presented below:

$$TC_i' = \int_{Xl_i}^{Xu_i} AX^b Y_i^c R_i^d \, dX = [A/(b+1)][Xu_i^{(b+1)} - Xl_i^{(b+1)}][Y_i^c R_i^d] \qquad (13)$$

where

TC_i' = estimated cost of lot i

Y_i = production rate for lot i

R_i = ratio of Y_i to Y_{i-1} (R_1 = 1 since there is no previous lot)

Xl_i = cumulative quantity through lot i-1

Xu_i = cumulative quantity through lot i

A = constant

b = learning curve parameter

c = production rate parameter

d = rate change parameter

This formulation reverts back to the TASC form for periods of stable production rates. That is, if $Y_i = Y_{i-1}$ then the value of R_i is one. This model follows the same logic as the TASC formulation and is therefore subject to the same criticisms.

Alternative one was analyzed by comparing the sum of squared residuals it yielded with those of the TASC model. The SAS output summary for alternative one is in Appendix D, section 4. Because the alternative formulation has four parameters, A, b, c, and d, it failed to provide predictions for those programs with four or less observations. This left 37 programs for which it was able to provide meaningful results. These results are listed below:

- All thirty-seven programs provided some improvement in residual sums of squares over the TASC formulation. The average improvement for these thirty-seven programs was 31.3% with a standard deviation of 27.4.

- Twenty-nine programs provided a ten percent or better improvement over the TASC model. The average improvement for these twenty-nine programs was 39.3% with a standard deviation of 25.6.

From this it is concluded that alternative one provides a significant improvement over the TASC formulation.

Analysis of 95% confidence intervals revealed results similar to those of the TASC model. Few programs showed that all four parameters were significant at this level. Even at the 80% level of confidence, no more than six programs could maintain statistical significance in all four parameters. None of the four parameters individually, A, b, c, or d, were consistently significant at either confidence level.

Alternative Two. The second alternative was introduced in equation 12. Integration with respect to X provides the following form:

$$TC_i' = \int_{Xl_i}^{Xu_i} AX^{(b+cY_i+dY_i^2)}\,dx =$$

$$A/(b+cY_i+dY_i^2+1)[Xu_i^{(b+cYi+dY_i^2+1)} - Xl_i^{(b+cY_i+dY_i^2+1)}] \qquad (14)$$

where

TC_i' = estimated total cost of lot i

Y_i = production rate for lot i (constant for a given lot)

Xl_i = cumulative quantity through lot i-1

Xu_i = cumulative quantity through lot i

A,b,c,d = model parameters

This formulation reverts back to the standard unit learning curve formulation if parameters c and d prove insignificant. Like alternative one this formulation failed to provide predictions for programs with four or less observations. The results of the 37 remaining programs are listed below:

- All but seven programs provided improvement in residual sums of squares over the TASC model. The average improvement for all programs was 27.9% with a standard deviation of 48.7.
- The average improvement for only those programs which improved was 47.5% with a standard deviation of 27.8.
- Nineteen programs showed significant improvements over alternative one.

From the information above it can be concluded that alternative two provides a significant improvement over the TASC formulation.

Analysis of 95% confidence revealed results similar to the previous two formulations. Few programs showed all parameters to be significant at the 95% level and made only minor improvement at the 80% level. None of the four parameters individually, A, b, c, or d, were consistently significant at either confidence level.

Comparison of Alternatives

Based on the results presented in the previous sections it can be concluded that both alternative one and alternative two provide more accurate estimates than the TASC formulation. Table II provides a summary of the residual sums of squares for all three formulations.

Since alternative one improved the residual sum of squares for every program while alternative two actually showed a decrease the residual sum of squares for seven programs it can be concluded that alternative one is more consistent than alternative two.

TABLE II

Residual Sum of Squares Summary

Program	SSR (TASC)	SSR (Alternative 1)	SSR (Alternative 2)
B-1B	12451	10352	5950
B-52	2448210	2325494	2001295
B-58	483386	---	---
A-10	8904	8877	9102
F-100	40716	29188	37852
F-101	23846	18336	20329
F-102	608	---	---
F-106	47059	---	---
F-15A/B	6603	5678	507
F-15C/D	51443	10637	17138
F-15E	26000	18494	25909
F-16A/B	85449	74316	77043
F-16E	347668	307960	114552
ARC-109V	.09382	.03448	.02289
ARC-54	6.61101	1.13114	1.30868
ASN-63	32.44155	20.40741	16.44965
ASN-70	.01845	.00271	.00246
CP-1035N	.90140	.44421	.15903
LANTIRN(Nav)	.04198	.02726	.01576
LANTIRN(T. Pod)	.09890	.08105	.05960
LANTIRN(T. Rec)	1.58543	1.05444	.65431
ASQ-133	3.01541	2.49691	1.98897
ASN-108	.79522	.36889	.24312
ASW-32	7.70686	3.94037	3.69461
JTIDS	.12319	.01258	.18462
HH-52	2.94411	.10740	.24595
CH-46	1218.9	1216.0	2709.1
H-53	177.4	121.1	141.2
CH-47	5154.1	4512.5	7158.4
H-54	125.5	125.2	69.6
HH-60D	2.07337	---	---
SH-3	289.9	284.7	200.3
LLLGB	7446217	7434216	5896176
CEM	647791386	361968375	172800755
GBU-15	148042874	120004955	74507311
AMRAAM	1658	1425	1635
HARM	399	364	760
MAVERICK	3385	3347	3898
AIM-7F(R)	250	156	339
AIM-7(GD)	84.8	73.4	73.5

Although alternative two was better than alternative one for nineteen programs this left eighteen programs for which alternative one was

better. There is a pattern indicated by program type for distinguishing between alternatives one and two. Alternative one was consistently more accurate than alternative two for fighter aircraft, helicopters, and tactical missiles. Alternative two in turn was consistently more accurate for bomber aircraft, electronics, and tactical armaments.

VI. Summary and Conclusion

The need to make decisions concerning production rate changes in today's cost conscious environment requires that accurate estimates be made of their impact on cost. The Analytic Sciences Corporation (TASC) developed a model for Air Force Systems Command (AFSC) for this purpose. This model, along with two alternative formulations of the production rate problem, was the subject of this investigation.

Findings

Analysis of the current Systems Command (TASC) model indicates that, based on residual sum of squares, it is able to provide a significant improvement over the standard learning curve model which it is derived from. Several issues were raised with the TASC formulation and with TASC's analysis of it. First, the nonlinear curve fitting technique used by TASC requires that production rate be held constant for a given lot. It was concluded that this assumption would not significantly affect the results of the model for its intended purpose. Next, it was concluded that the failure of TASC's formulation to solve for the optimal rate of production which is indicated by the bathtub shaped long run cost curve will result in distorted parameter estimates if the data is not adjusted prior to curve fitting. Third, it was concluded that use of the pseudo-R^2 as a measure of fit is invalid and, finally, it was shown that the model parameters were not statistically significant on a consistent basis.

The first alternative production rate formulation, one which incorporates an additional variable for changes in production rate, showed that based on residual sum of squares it is capable of consistently

providing more accurate estimates than the TASC formulation. Since this first alternative is merely an extention of the TASC formulation it is subject to the same criticisms. Analysis also revealed that the parameters for alternative one were not consistently significant.

The second alternative is based on the unit learning curve model as are the TASC formulation and alternative one. However, this model incorporates an exponent which is a quadratic function of production rate. This allows it to be able to directly solve for an optimal production rate from the data. It was shown that based on residual sum of squares this model was also capable of providing more accurate estimates than the TASC formulation. However, like the other two models, none of the parameters for alternative two proved to be statistically significant on a consistent basis.

Comparison of the alternatives revealed that alternative one could provide more accurate estimates than the TASC formulation on a more consistent basis than alternative two. There is some evidence to suggest that alternative two will provide more accurate estimates than alternative one for certain types of programs however, this requires further research.

Based upon the above conclusions it is recommended that Systems Command immediately incorporate alternative one as the new AFSC production rate model. The conversion would only require the addition of the new production rate change variable to the current AFSC model. Additionally, since the new variable is based on production rate the resultant model would not require additional data which is not used in the current model. Parameters to update the Systems Command model database have already been estimated as part of this thesis and are included in

Appendix D, section 4.

Research Limitations

The research which is the subject of this thesis is subject to several limitations. The most obvious limitation is that of the three production rate formulations none have parameters which are statistically significant on a consistent basis. This could be caused by the small number of observations available for each program. Since all of the models are logically sound, it is assumed that if additional observations were available the statistical significance of the parameters would increase.

Another limitation is the fact that it was not possible to determine with certainty if the SAS nonlinear curve fitting procedure was capable of accurately replicating the results acheived using the TASC Rate Analysis Curve (TRAC) procedure. This limitation, which was discussed in chapter five, is due to unresolved issues with the output reported by TASC.

Finally, this research is limited in that the effects of production rate changes still cannot be separated from the effects of learning because of collinearity in the data (see chapter two). The nonlinear curve fitting techniques, although they avoid dealing with the problems of multicollinearity in the data, do not solve it. However, as long as the relationship among the model's variables remains constant this presents no particular problem for estimating.

Areas for Future Research

The issues involved with estimating the cost impact of production rate changes are far from resolved. Each new research effort brings an

answer a little closer while simultaneously raising still more issues. Thus, the subject is wide open to future investigation. Several topics are of particular interest.

As mentioned previously, alternatives one and two should be further investigated to determine if there is a relationship between program type and their relative abilities to provide more accurate estimates. If this could be adequately demonstrated it would suggest using both formulations according to their relative strengths.

Another area for future research is the idea of a "toe up" at the end of learning curves. Many programs experience a slight upturn in the learning curve during the last one or two production lots. This can be attributed in part to, among other things, workers attempting to forestall layoffs or transfers to others programs. It is also possible that the low rates of production typically encountered at the ends of major programs could be causing a flattening or even an upturn in the normal learning curve. If this could be empirically verified it would help further improve the accuracy of learning curve estimates.

Finally, a topic which is still wide open to research is the area of accounting for fixed overhead costs. Although it was decided that the affects of fixed costs could be ignored by considering only recurring costs, this is not entirely true. Since major defense contractors usually have the bulk of their business base tied up into just a few major contracts, large changes in the production rate of one program could have a significant cost impact on others due to the fact that fixed costs will be allocated over a smaller base. While this is not a production rate problem directly, the implications for decision makers trying to control weapon systems costs are the same.

Appendix A: Data

All data used in this thesis was extracted from documentation of the Air Force Systems Command Production Rate Model which was developed by The Analytic Sciences Corporation (18). There are two key reasons for selecting this database. First, it was readily available in published documentation of the AFSC model. TASC originally obtained the raw data from official Air Force sources such as system program offices, the AFSC history office, and the Pentagon. The majority of this raw data was compiled during the AFSC sponsored Affordable Acquisition Approach study, completed in 1983 (15). The data was converted to constant 1984 dollars using rates supplied through the AFSC comptroller. Second, it was chosen to be consistent with the work TASC performed. This helps maintain the validity of the evaluation of the TASC model and provides a consistent basis for comparing the TASC model with other formulations.

The actual database consists of 35 programs in six categories including bomber aircraft, fighter aircraft, electronics, helicopters, tactical armaments, and tactical missiles. Some programs, such as the F-15 and F-16, were produced as different models (e.g. F-15A/B and F-15C/D). Others, such as the AIM-7F, were produced by multiple manufacturers (i.e. General Dynamics and Raytheon). Since differences among model types and manufacturers can influence learning and production rate considerations several programs have been broken out and their various excursions treated separatly. This is consistent with TASC's work. Including the excursions there are a total of 41 separate data sets. Each set has from four to twelve observations with an average of seven.

All data in this appendix appears in millions of constant fiscal year 1984 dollars. Only recurring, average unit costs are given. Quantity values are for annual lots unless otherwise indicated (i.e. when multiple lots are given for a single fiscal year). Where necessary, values were converted to an annual production rate basis for consistency before analyses were performed. Units being produced concurrently for other services are included where applicable.

A.1 - Bomber Aircraft Programs

TABLE A.1.1

B-1B Cost/Quantity Data

(FY 84 Dollars)

Fiscal Year	Quantity	Recurring Average Unit Cost
1982	1	535.8
1983	7	260.3
1984	10	200.5
1985	34	142.0
1986	48	111.3

TABLE A.1.2

B-52 Cost/Quantity Data

(FY 84 Dollars)

Fiscal Year	Quantity	Recurring Average Unit Cost
1952	20	112.5
1953	43	37.0
1954	25	28.6
1955	77	32.3
1956	133	23.4
1957	202	28.4
1958	101	27.3
1959	39	27.3
1960	62	35.4
1961	40	35.0

TABLE A.1.3

B-58 Cost/Quantity Data

(FY 84 Dollars)

Fiscal Year	Quantity	Recurring Average Unit Cost
1958	17	93.86
1959	36	80.26
1960	20	73.16
1961	30	36.56

A.2 - Fighter Aircraft Programs

TABLE A.2.1

A-10 Cost/Quantity Data

(FY 84 Dollars)

Fiscal Year	Quantity	Recurring Average Unit Cost
1975	22	12.37
1976	53	9.16
197T	20	8.20
1977	100	8.20
1978	144	7.82
1979	144	7.59
1980	144	7.82
1981	60	10.18
1982	20	13.64

TABLE A.2.2

F-100 Cost/Quantity Data

(FY 84 Dollars)

Fiscal Year	Quantity	Recurring Average Unit Cost
1952	23	6.51
1953	545	3.45
1954	593	3.08
1955	559	3.10
1956	557	2.50

TABLE A.2.3

F-101 Cost/Quantity Data

(FY 84 Dollars)

Fiscal Year	Quantity	Recurring Average Unit Cost
1954	31	16.85
1955	84	7.58
1956	309	6.91
1957	206	5.76
1958	84	5.27
1959	93	5.22

TABLE A.2.4

F-102 Cost/Quantity Data

(FY 84 Dollars)

Fiscal Year	Quantity	Recurring Average Unit Cost
1954	37	11.66
1955	108	5.17
1956	562	3.50
1957	140	2.21

TABLE A.2.5

F-106 Cost/Quantity Data

(FY 84 Dollars)

Fiscal Year	Quantity	Recurring Average Unit Cost
1956	42	34.19
1957	88	10.54
1958	45	11.64
1959	165	7.59

TABLE A.2.6

F-15A/B Cost/Quantity Data

(FY 84 Dollars)

Fiscal Year	Quantity	Recurring Average Unit Cost
1973	30	25.597
1974	62	19.556
1975	72	17.183
1976	108	17.126
197T	24	16.021
1977	108	16.272

TABLE A.2.7

F-15C/D Cost/Quantity Data

(FY 84 Dollars)

Fiscal Year	Quantity	Recurring Average Unit Cost
1978	97	17.249
1979	78	15.588
1980	60	15.508
1981	42	17.665
1982	36	19.943
1983	39	19.308
1984	36	21.954
1985	48	21.017

TABLE A.2.8

F-15E Cost/Quantity Data

(FY 84 Dollars)

Fiscal Year	Quantity	Recurring Average Unit Cost
1986	60	20.544
1987	72	19.203
1988	96	17.608
1989	96	16.175
1990	96	16.041
1991	96	17.927

TABLE A.2.9

F-16A/B Cost/Quantity Data

(FY 84 Dollars)

Fiscal Year	Quantity	Recurring Average Unit Cost
1978	105	10.14
1979	145	7.74
1980	175	8.04
1981	180	5.05
1982	120	5.13

TABLE A.2.10

F-16E Cost/Quantity Data

(FY 84 Dollars)

Fiscal Year	Quantity	Recurring Average Unit Cost
1983	120	9.86
1984	144	10.58
1985	150	14.55
1986	216	11.93
1987	216	11.28
1988	216	11.02
1989	216	10.88
1990	216	10.69
1991	216	10.61
1992	216	10.54

A.3 - Electronics Programs

TABLE A.3.1

ARC-109V Cost/Quantity Data

(FY 84 Dollars)

Fiscal Year	Quantity	Recurring Average Unit Cost
1972	4	0.0487
1973	24	0.0393
1974	79	0.0285
1975	226	0.0313
1976	108	0.0303

TABLE A.3.2

ARC-54 Cost/Quantity Data

(FY 84 Dollars)

Fiscal Year	Quantity	Recurring Average Unit Cost
1964	900	0.0210
1964	853	0.0165
1965	1381	0.0164
1966	1160	0.0145
1966	300	0.0144
1966	3103	0.0139
1966	2650	0.0143

TABLE A.3.3

ASN-63 Cost/Quantity Data

(FY 84 Dollars)

Fiscal Year	Quantity	Recurring Average Unit Cost
1966	781	0.1866
1967	149	0.1744
1968	287	0.1769
1969	141	0.1817
1970	92	0.1772
1971	135	0.2189
1972	108	0.1911
1973	158	0.1917
1974	36	0.2005
1975	36	0.2145

TABLE A.3.4

ASN-70 Cost/Quantity Data

(FY 84 Dollars)

Fiscal Year	Quantity	Recurring Average Unit Cost
1966	152	0.0350
1967	250	0.0353
1969	81	0.0342
1970	58	0.0356
1971	26	0.0370
1972	8	0.0399
1973	8	0.0370
1974	11	0.0427

TABLE A.3.5

ASN-99 Cost/Quantity Data

(FY 84 Dollars)

Fiscal Year	Quantity	Recurring Average Unit Cost
1968	157	0.0464
1969	196	0.0404
1970	185	0.0413
1971	243	0.0433
1972	24	0.0570
1973	72	0.0624
1974	56	0.0635
1975	117	0.0684

TABLE A.3.6

CP-1035N Cost/Quantity Data

(FY 84 Dollars)

Fiscal Year	Quantity	Recurring Average Unit Cost
1970	12	0.1248
1971	26	0.0903
1972	48	0.1236
1973	48	0.1287
1974	50	0.1310
1975	80	0.1154

TABLE A.3.7

LANTIRN (Navigation Pod) Cost/Quantity Data

(FY 84 Dollars)

Fiscal Year	Quantity	Recurring Average Unit Cost
1985	4	1.7500
1986	34	1.3199
1987	138	1.0761
1988	144	0.9679
1989	144	0.9184
1990	144	0.8854
1991	116	0.8643

TABLE A.3.8

LANTIRN (Target Pod) Cost/Quantity Data

(FY 84 Dollars)

Fiscal Year	Quantity	Recurring Average Unit Cost
1985	4	1.4375
1986	34	1.1286
1987	128	0.9375
1988	144	0.8490
1989	144	0.8081
1990	144	0.7795
1991	116	0.7619

TABLE A.3.9

LANTIRN (Target Recognizer) Cost/Quantity Data

(FY 84 Dollars)

Fiscal Year	Quantity	Recurring Average Unit Cost
1988	79	0.4383
1989	192	0.3353
1990	192	0.2975
1991	192	0.2865
1992	65	0.2693

TABLE A.3.10

ASQ-133 Cost/Quantity Data

(FY 84 Dollars)

Fiscal Year	Quantity	Recurring Average Unit Cost
1970	14	0.5856
1971	19	0.5862
1972	68	0.4255
1973	67	0.3828
1974	81	0.3535
1975	58	0.3355

TABLE A.3.11

ASN-108 Cost/Quantity Data

(FY 84 Dollars)

Fiscal Year	Quantity	Recurring Average Unit Cost
1972	8	0.1373
1973	31	0.1048
1974	77	0.0874
1975	216	0.0943
1976	108	0.0872

TABLE A.3.12

ASW-32 Cost/Quantity Data

(FY 84 Dollars)

Fiscal Year	Quantity	Recurring Average Unit Cost
1970	12	0.2338
1971	26	0.1643
1972	48	0.1524
1973	48	0.0974
1974	50	0.1441
1975	80	0.1518

TABLE A.3.13

JTIDS Cost/Quantity Data

(FY 84 Dollars)

Fiscal Year	Quantity	Recurring Average Unit Cost
1986	45	0.4068
1987	76	0.2764
1988	77	0.2466
1989	72	0.2308
1990	57	0.2205

A.4 - Helicopter Programs

TABLE A.4.1

HH-52 Cost/Quantity Data

(FY 84 Dollars)

Fiscal Year	Quantity	Recurring Average Unit Cost
1963	28	1.577
1964	15	1.104
1965	17	1.085
1966	15	1.012
1967	12	1.041
1968	12	1.055

TABLE A.4.2

CH-46 Cost/Quantity Data

(FY 84 Dollars)

Fiscal Year	Quantity	Recurring Average Unit Cost
1963	14	7.541
1964	36	3.898
1965	60	2.766
1966	85	2.419
1967	199	1.986
1968	92	2.236
1969	90	2.370
1970	48	2.547

TABLE A.4.3

H-53 Cost/Quantity Data

(FY 84 Dollars)

Fiscal Year	Quantity	Recurring Average Unit Cost
1965	10	6.752
1966	131	4.264
1968	140	3.762
1969	12	3.382
1970	30	3.341
1971	3	3.154
1973	30	3.685
1974	6	3.947

TABLE A.4.4

CH-47 Cost/Quantity Data

(FY 84 Dollars)

Fiscal Year	Quantity	Recurring Average Unit Cost
1962	18	6.181
1963	24	5.226
1964	24	4.559
1965	60	3.459
1966	72	2.760
1967	160	2.307
1968	84	2.313
1969	143	2.695
1970	45	3.463
1971	36	3.085
1972	12	3.671
1973	12	3.852

TABLE A.4.5

H-54 Cost/Quantity Data

(FY 84 Dollars)

Fiscal Year	Quantity	Recurring Average Unit Cost
1964	6	5.248
1967	24	3.388
1968	30	2.801
1969	23	3.402
1970	6	3.083

TABLE A.4.6

HH-60D Cost/Quantity Data

(FY 84 Dollars)

Fiscal Year	Quantity	Recurring Average Unit Cost
1986	3	9.2
1987	25	7.1
1988	35	6.7
1989	29	6.6

TABLE A.4.7

SH-3 Cost/Quantity Data

(FY 84 Dollars)

Fiscal Year	Quantity	Recurring Average Unit Cost
1960	20	3.327
1961	49	2.480
1962	71	2.319
1963	45	1.811
1964	36	1.870
1965	36	1.589
1966	30	1.703
1967	48	1.930
1970	15	2.144

A.5 - Tactical Armament Programs

TABLE A.5.1

Low Level Laser Guided Bomb (LLLGB) Cost/Quantity Data

(FY 84 Dollars)

Fiscal Year	Quantity	Recurring Average Unit Cost
1983	1600	0.0275
1984	2950	0.0206
1985	3740	0.0189
1986	8980	0.0162
1987	9620	0.0147
1988	14400	0.0137
1989	15600	0.0129
1990	15600	0.0123
1991	15600	0.0118
1992	11910	0.0115

TABLE A.5.2

Combined Effects Munitions (CEM) Cost/Quantity Data

(FY 84 Dollars)

Fiscal Year	Quantity	Recurring Average Unit Cost
1983	172	0.06924
1984	1260	0.03038
1985	6125	0.01988
1986	14220	0.01765
1987	28450	0.01619
1988	35020	0.01401
1989	48910	0.01258
1990	37509	0.01181

TABLE A.5.3

GBU-15 Cost/Quantity Data

(FY 84 Dollars)

Fiscal Year	Quantity	Recurring Average Unit Cost
1980	40	0.1975
1981	65	0.2000
1982	340	0.1439
1983	250	0.1483
1984	320	0.1308
1985	600	0.1718
1986	600	0.1539
1987	600	0.1483
1988	600	0.1420

A.6 - Tactical Missile Programs

TABLE A.6.1

AMRAAM Cost/Quantity Data

(FY 84 Dollars)

Fiscal Year	Quantity*	Recurring Average Unit Cost
1985	194	1.233
1986	1057	0.512
1987	1964	0.342
1988	2996	0.257
1989	2900	0.232
1990	2900	0.194
1991	2900	0.182
1992	3000	0.170
1993	3000	0.158
1994	3763	0.155

* Includes Navy Buy Quantities

TABLE A.6.2

HARM Cost/Quantity Data

(FY 84 Dollars)

Fiscal Year	Quantity	Recurring Average Unit Cost
1981	80	0.809
1982	236	0.517
1983	396	0.400
1984	687	0.314
1985	1745	0.249
1986	2468	0.223
1987	2119	0.208
1988	2132	0.197
1989	3000	0.184
1990	3000	0.177
1991	1098	0.196

TABLE A.6.3

IIR Maverick Cost/Quantity Data

(FY 84 Dollars)

Fiscal Year	Quantity	Recurring Average Unit Cost
1982	200	0.309
1983	900	0.135
1984	2600	0.083
1985	5729	0.082
1986	9000	0.062
1987	12000	0.057
1988	12000	0.055
1989	12000	0.053
1990	6235	0.057

TABLE A.6.4

AIM-7F (Raytheon) Cost/Quantity Data

(FY 84 Dollars)

Fiscal Year	Quantity	Recurring Average Unit Cost
1972	100	0.741
1973/74	225	0.378
1975	600	0.199
1976	800	0.169
1977	1100	0.134
1978	1400	0.116
1979	900	0.111
1980	1144	0.095

TABLE A.6.5

AIM-7F (General Dynamics) Cost/Quantity Data

(FY 84 Dollars)

Fiscal Year	Quantity	Recurring Average Unit Cost
1975	15	1.551
1976	70	0.379
1977	210	0.228
1978	210	0.195
1979	750	0.130
1980	1310	0.090

Appendix B: Newton's Method

This appendix gives a brief description of the nonlinear curve fitting technique, Newton's Method, which forms the basis for TASC's approach to solving the current production rate formulation. This formulation can be found in chapter two, equation six.

To solve equation six for parameters A, b and, c TASC first solved for total lot cost (TC_i') as shown in chapter three, equation nine. Newton's Method then minimizes the sum of squared errors between this predicted total lot cost and the actual total lot cost as indicated in chapter three, equation ten. This equation is repeated below for convenience:

$$\sum_{i=1}^{N} w_i [TC_i - TC_i']^2 \qquad (10)$$

where

TC_i = actual total lot cost

TC_i' = predicted total lot cost

N = total number of lots

w_i = weight of lot i (where $\sum w_i = 1$)

To minimize the sum of squared errors between the actual and predicted total lot costs Newton's Method must be initialized with some arbitrary parameter values. (Note that a solution will be reached in less steps if the initial parameter values are close to the true parameters.) The sum of squared errors is calculated and then, based on a series of partial derivitives with respect to the parameters, Newton's Method calculates a new set of parameter values. The sum of squared

errors for this new set of parameters is then compared to the previous value. Successive iterations of this process eventually converge on a solution. The solution is reached when the decrease in sum of squared errors becomes infinitely small. (In practical applications an arbitrarily small value is used to evaluate convergence.)

This is a basic description of how Newton's Method is used to solve for the parameters in the three models in this thesis. For a more detailed, technical, discussion of Newton's Method refer to Linear and Nonlinear Programming, by David G. Luenberger (10).

Appendix C: SAS Programs

This appendix lists the three Statistical Analysis System (SAS) programs used in this thesis. The first program includes a description of the program routines to assist future researchers. For a detailed discussion of the various program steps consult the SAS User's Guide: Statistics (11).

C.1 - The TASC Formulation

This section presents the program which was used for the TASC formulation. It is based on the program provided to Air Force Systems Command by TASC in documentation of the AFSC production rate model (18: Appendix B, 6-7). The program has been modified somewhat so that the variable names are consistent with those used in this thesis.

```
CMS FILEDEF INP DISK BOMBER DATA;
```

This line identifies a datafile named BOMBER to the command system on the Boeing Computer Services system and gives it the name INP.

```
DATA INP;
   INFILE INP;
   INPUT SYS $ LOT QTY AUC;
```

These lines input data from the file INP. Four variables are input for each observation: (1) SYS $ is the name of the weapon system, such as B-1B etc., (2) LOT is the production lot number, (3) QTY is the lot quantity and, (4) AUC is the average unit cost for the lot.

```
   RETAIN XL 0 XU 0;
      IF LOT = 1 THEN XU = 0;
      IF LOT > 0 THEN XU + QTY;
         XL = XU - QTY;
      IF LOT = 1 THEN XL = .0000001;
```

These lines initialize the upper and lower bounds of each lot (X_u, X_l).

```
        YI = QTY;
```

Sets production rate Y_i equal to lot quantity.

```
        PLOTPT = XL + QTY/2;
     IF LOT = 1 THEN PLOTPT = 0.5 + QTY/3.0;
```

Sets rule of thumb lot plot points.

```
        LPLOTPT = LOG(PLOTPT);
        LAUC = LOG(AUC);
        LYI = LOG(YI);
```

Performs log-linear transformations.

```
        TCA = QTY * AUC;
```

Sets the actual total lot cost.

```
PROC SORT
     DATA = INP;
     BY SYS;
```

Sorts the data by system.

```
PROC REG
     OUTEST = EST;
     BY SYS;
     MODEL LAUC = LPLOTPT LYI;
 DATA OUT;
   SET EST;
       A1 = EXP(INTERCEP);
       B1 = EXP(LPLOTPT * LOG(2));
       C1 = EXP(LYI * LOG(2));
 DATA MER;
   MERGE INP OUT;
   BY SYS;
   DROP _TYPE_ _MODEL_ _DEPVAR_ _SIGMA_ LAUC;
```

Performs normal linear least squares regression on the transformed variables and creates the data set MER by merging the data set INP with the output from the regression procedure. The variables A1, B1 and, C1 will be used to initialize the search procedure in the PROC NLIN routine. This cuts down on the time needed for the nonlinear procedure to converge.

```
PROC NLIN
      DATA = MER
      METHOD = MARQUARDT
      MAXITER = 50
      CONVERGE = .00000000000000001;
      PARMS A = 1
            B = 1
            C = 1;
         IF _ITER_ = 0 THEN IF _N_ = 1 THEN DO;
            A = A1;
            B = LOG(B1)/LOG(2);
            C = LOG(C1)/LOG(2);
         END;
```

This routine initializes the PROC NLIN procedure.

```
     MODEL TCA = YI**C * (XU**(B+1) - XL**(B+1)) * A / (B+1);
       DER.A = YI**C * (XU**(B+1) - XL**(B+1)) / (B+1);
       DER.B = A * YI**C * (XU**(B+1) * LOG(XU) - XL**(B+1) * LOG(XL))
               / (B+1) - YI**C * (XU**(B+1) - XL**(B+1)) * A / (B+1)**2;
       DER.C = LOG(YI) * (XU**(B+1) - XL**(B+1)) * YI**C * A / (B+1);
```

These five lines give the model and derivative statements needed to run

PROC NLIN.

```
     BY SYS;
     OUTPUT OUT = NOUT
            PARMS = AO BO CO
            PREDICTED = TCP
            SSE = SS
            RESIDUAL = RES;
 DATA OUT2;
   SET NOUT;
       SB = EXP(BO * LOG(2));
       SC = EXP(CO * LOG(2));
       UCP = TCP/QTY;
       DIF = AUC - UCP;
       PCT = 100 * DIF/AUC;
PROC PRINT
      DATA = OUT2;
      VAR LOT XL XU YI AUC UCP DIF PCT SB SC;
      BY SYS;
```

These lines prepare the output from PROC NLIN into the report form used

in Appendix D.

C.2 - Alternative One

This section presents the program used for alternative one.

```
     CMS FILEDEF INP DISK BOMBER DATA;
DATA INP;
   INFILE INP;
   INPUT SYS $ LOT QTY AUC;
   RETAIN XL 0 XU 0 VI 0 YI 0;
      IF LOT = 1 THEN XU = 0;
      IF LOT > 0 THEN XU + QTY;
         XL = XU - QTY;
      IF LOT = 1 THEN XL = .0000001;
      YI = QTY;
      PLOTPT = XL + QTY/2;
   IF LOT = 1 THEN PLOTPT = 0.5 + QTY/3.0;
      LPLOTPT = LOG(PLOTPT);
      LAUC = LOG(AUC);
      TCA = QTY * AUC;
      LYI = LOG(YI);
IF LOT = 1 THEN VI = 1;
IF LOT > 1 THEN VI = QTY/LAG1(QTY);
PROC SORT DATA = INP;
     BY SYS;
PROC REG NOPRINT OUTEST = EST;
     BY SYS;
     MODEL LAUC = LPLOTPT LYI;
       DATA OUT;
       SET EST;
        A1 = EXP(INTERCEP);
        B1 = EXP(LPLOTPT * LOG(2));
        C1 = EXP(LYI * LOG(2));
DATA MER;
     MERGE INP OUT;
       BY SYS;
       DROP _TYPE_ _MODEL_ _DEPVAR_ _SIGMA_ LAUC;
PROC NLIN DATA = MER
          METHOD = MARQUARDT
          MAXITER = 100
          CONVERGE = .00000000000000001;
          PARMS A = 1
                B = 1
                C = 1
                D = 1;
     IF _ITER_ = 0 THEN IF _N_ = 1 THEN DO;
                A = A1;
                B = LOG(B1)/LOG(2);
                C = LOG(C1)/LOG(2);
                D = .1;
     END;
     MODEL TCA = YI**C * VI**D * (XU**(B+1) - XL**(B+1)) * A / (B+1);
         DER.A = YI**C * VI**D * (XU**(B+1) - XL**(B+1)) / (B+1);
         DER.B = (XU**(B+1)*LOG(XU)-XL**(B+1)*LOG(XL))*A*YI**C*VI**D/
                 (B+1) - YI**C*VI**D*(XU**(B+1)-XL**(B+1))*A/(B+1)**2;
         DER.C = LOG(YI)*(XU**(B+1)-XL**(B+1))*YI**C*VI**D*A/(B+1);
         DER.D = LOG(VI)*(XU**(B+1)-XL**(B+1))*YI**C*VI**D*A/(B+1);
     BY SYS;
```

```
OUTPUT OUT = NOUT PARMS = AO BO CO DO PREDICTED = TCP SSE = SS
             RESIDUAL = RES;
    DATA OUT2;
    SET NOUT;
      SB = EXP(BO * LOG(2));
      SC = EXP(CO * LOG(2));
      UCP = TCP/QTY;
      DIF = AUC - UCP;
      PCT = 100 * DIF/AUC;
PROC PRINT DATA = OUT2;
      VAR LOT XL XU YI VI AUC UCP DIF PCT;
        BY SYS;
```

C.3 - Alternative Two

This section presents the program used for alternative two.

```
CMS FILEDEF INP DISK TMISS DATA;
DATA INP;
   INFILE INP;
   INPUT SYS $ LOT QTY AUC;
   RETAIN XL 0 XU 0;
      IF LOT = 1 THEN XU = 0;
      IF LOT > 0 THEN XU + QTY;
         XL = XU - QTY;
      IF LOT = 1 THEN XL = .0000001;
      YI = QTY;
      TCA = QTY * AUC;
PROC SORT DATA = INP;
     BY SYS;
PROC NLIN DATA = INP
          METHOD = MARQUARDT
          MAXITER = 100
          CONVERGE = .00000000000000001;
          PARMS A = 1
                B = 0
                C = 0
                D = 0;
       F1 = (B + C*YI + D*YI**2 + 1);
       F2 = (XU**F1 - XL**F1);
MODEL TCA = (A/F1)*F2;
    DER.A = 1/F1*F2;
    DER.B = A/F1*XU**F1*LOG(XU) - A/F1**2*XU**F1 -
            A/F1*XL**F1*LOG(XL) + A/F1**2*XL**F1;
    DER.C = A/F1*XU**F1*LOG(XU)*YI - A/F1**2*YI*XU**F1 -
            A/F1*XL**F1*LOG(XL)*YI + A/F1**2*YI*XL**F1;
    DER.D = A/F1*XU**F1*LOG(XU)*YI**2 - A/F1**2*YI**2*XU**F1 -
            A/F1*XL**F1*LOG(XL)*YI**2 + A/F1**2*YI**2*XL**F1;
BY SYS;
OUTPUT OUT = NOUT PARMS = AO BO CO DO PREDICTED = TCP  RESIDUAL = RES;
```

```
    DATA OUT2;
    SET NOUT;
      UCP = TCP/QTY;
      DIF = AUC - UCP;
      PCT = 100 * DIF/AUC;
PROC PRINT DATA = OUT2;
      VAR LOT XL XU YI AUC UCP DIF PCT ;
  BY SYS;
```

Appendix D: Computer Output Summary

This appendix contains summary results of the various computer runs used for the analyses in this thesis. Results are categorized by computer run and subcategorized by program type and then by program.

D.1 - ICLOT Runs

This first set of results is from the ICLOT learning curve program. Access to the ICLOT program was through the Boeing Computer Services system. Values for the sum of squared residuals were not output by ICLOT. These were calculated by hand and are based on actual and predicted total lot costs to be consistent with the SAS output.

D.1.1 - Bomber Aircraft Programs

B-1B

LEAST SQUARES ANALYSIS BASED ON THE UNIT CURVE THEORY
COMPUTED VALUE OF FIRST UNIT--A = 443.3813
REGRESSION SLOPE COEFFICIENT--B =-.3213111
IMPROVEMENT CURVE PERCENTAGE = 80.03421
COEFFICIENT OF CORRELATION--R =-.9952786
COEFFICIENT OF DETERMINATION--R2= .9905794
RESIDUAL SUM OF SQUARES = 28429

COMPUTED LOT MIDPOINT--X	CALCULATED Y AT X	ACTUAL Y	PERCENTAGE DIFFERENCE
1	443.3813	535.8	20.79999
4.396258	275.5164	260.3	-5.4
13.08253	194.076	200.5	3.299999
33.59782	143.3365	142	-.8
74.80161	110.8331	111.3	.4

B-52

LEAST SQUARES ANALYSIS BASED ON THE UNIT CURVE THEORY

COMPUTED VALUE OF FIRST UNIT--A = 70.86641
REGRESSION SLOPE COEFFICIENT--B =-.1533973
IMPROVEMENT CURVE PERCENTAGE = 89.91306
COEFFICIENT OF CORRELATION--R =-.5717497
COEFFICIENT OF DETERMINATION--R2= .3268977
RESIDUAL SUM OF SQUARES = 8515485

B-52 (Continued)

COMPUTED LOT MIDPOINT--X	CALCULATED Y AT X	ACTUAL Y	PERCENTAGE DIFFERENCE
7.896764	51.61479	112.5	118
39.74203	40.28281	37	-8
75.60327	36.4987	28.60001	-21.5
124.715	33.80121	32.3	-4.299999
228.2677	30.80785	23.39999	-23.89999
394.5161	28.32768	28.39999	.3
550.1123	26.91922	27.3	1.4
620.8564	26.42427	27.3	3.299999
671.2341	26.10992	35.39999	35.59999
722.3591	25.81757	35	35.59999

B-58

LEAST SQUARES ANALYSIS BASED ON THE UNIT CURVE THEORY

COMPUTED VALUE OF FIRST UNIT--A = 203.4711
REGRESSION SLOPE COEFFICIENT--B =-.3160586
IMPROVEMENT CURVE PERCENTAGE = 80.32613
COEFFICIENT OF CORRELATION--R =-.7533017
COEFFICIENT OF DETERMINATION--R2= .5674634
RESIDUAL SUM OF SQUARES = 705710

COMPUTED LOT MIDPOINT--X	CALCULATED Y AT X	ACTUAL Y	PERCENTAGE DIFFERENCE
6.478471	112.7275	93.86	-16.59999
33.3586	67.15526	80.25999	19.5
63.15335	54.88731	73.16	33.29999
87.9391	49.43419	36.56	-25.89999

D.1.2 - Fighter Aircraft Programs

A-10

LEAST SQUARES ANALYSIS BASED ON THE UNIT CURVE THEORY

COMPUTED VALUE OF FIRST UNIT--A = 10.69671
REGRESSION SLOPE COEFFICIENT--B =-4.438187E-02
IMPROVEMENT CURVE PERCENTAGE = 96.97052
COEFFICIENT OF CORRELATION--R =-.3071097
COEFFICIENT OF DETERMINATION--R2= 9.431630E-02
RESIDUAL SUM OF SQUARES = 83457

A-10 (Continued)

COMPUTED LOT MIDPOINT--X	CALCULATED Y AT X	ACTUAL Y	PERCENTAGE DIFFERENCE
8.924471	9.706474	12.37	27.39999
46.3266	9.022305	9.16	1.5
85.2988	8.781147	8.2	-6.5
142.4514	8.583539	8.2	-4.4
264.0835	8.351582	7.82	-6.299999
409.3027	8.190732	7.59	-7.2
553.8953	8.081494	7.82	-3.099999
657.4314	8.020264	10.18	26.89999
697.436	7.999266	13.64	70.5

F-100

LEAST SQUARES ANALYSIS BASED ON THE UNIT CURVE THEORY

COMPUTED VALUE OF FIRST UNIT--A = 7.845584
REGRESSION SLOPE COEFFICIENT--B =-.1403805
IMPROVEMENT CURVE PERCENTAGE = 90.72798
COEFFICIENT OF CORRELATION--R =-.9007197
COEFFICIENT OF DETERMINATION--R2= .8112959
RESIDUAL SUM OF SQUARES = 42183

COMPUTED LOT MIDPOINT--X	CALCULATED Y AT X	ACTUAL Y	PERCENTAGE DIFFERENCE
8.987864	5.764352	6.51	12.9
230.6466	3.65522	3.54	-3.099999
845.147	3.046078	3.08	1.099999
1430.631	2.829117	3.1	9.599999
1991.601	2.700733	2.5	-7.299999

F-101

LEAST SQUARES ANALYSIS BASED ON THE UNIT CURVE THEORY

COMPUTED VALUE OF FIRST UNIT--A = 23.89137
REGRESSION SLOPE COEFFICIENT--B =-.2292152
IMPROVEMENT CURVE PERCENTAGE = 85.30988
COEFFICIENT OF CORRELATION--R =-.9475103
COEFFICIENT OF DETERMINATION--R2= .8977758
RESIDUAL SUM OF SQUARES = 28812

F-101 (Continued)

COMPUTED LOT MIDPOINT--X	CALCULATED Y AT X	ACTUAL Y	PERCENTAGE DIFFERENCE
11.37807	13.68277	16.85001	23.09999
68.13843	9.078199	7.58	-16.39999
250.2322	6.737592	6.91	2.599999
523.3474	5.689226	5.76	1.2
671.9695	5.372419	5.27	-1.799999
760.436	5.22225	5.22	0

F-102

LEAST SQUARES ANALYSIS BASED ON THE UNIT CURVE THEORY

COMPUTED VALUE OF FIRST UNIT--A = 28.67297
REGRESSION SLOPE COEFFICIENT--B =-.3634803
IMPROVEMENT CURVE PERCENTAGE = 77.72871
COEFFICIENT OF CORRELATION--R =-.970254
COEFFICIENT OF DETERMINATION--R2= .9413928
RESIDUAL SUM OF SQUARES = 16903

COMPUTED LOT MIDPOINT--X	CALCULATED Y AT X	ACTUAL Y	PERCENTAGE DIFFERENCE
12.58532	11.42073	11.66	2.099999
83.51585	5.740471	5.17	-9.799999
378.6965	3.313713	3.5	5.599999
776.0654	2.553004	2.21	-13.3

F-106

LEAST SQUARES ANALYSIS BASED ON THE UNIT CURVE THEORY

COMPUTED VALUE OF FIRST UNIT--A = 104.0728
REGRESSION SLOPE COEFFICIENT--B =-.4769318
IMPROVEMENT CURVE PERCENTAGE = 71.85039
COEFFICIENT OF CORRELATION--R =-.9600124
COEFFICIENT OF DETERMINATION--R2= .9216237
RESIDUAL SUM OF SQUARES = 76697

COMPUTED LOT MIDPOINT--X	CALCULATED Y AT X	ACTUAL Y	PERCENTAGE DIFFERENCE
13.32158	30.26921	34.19	13
30.58257	12.82894	10.54	-17.7
152.1825	9.473236	11.64	22.89999
251.3348	7.457287	7.59	1.799999

F-15A/B

LEAST SQUARES ANALYSIS BASED ON THE UNIT CURVE THEORY

COMPUTED VALUE OF FIRST UNIT--A = 33.03304
REGRESSION SLOPE COEFFICIENT--B =-.1245996
IMPROVEMENT CURVE PERCENTAGE = 91.72585
COEFFICIENT OF CORRELATION--R =-.9692332
COEFFICIENT OF DETERMINATION--R2= .939413
RESIDUAL SUM OF SQUARES = 7558

COMPUTED LOT MIDPOINT--X	CALCULATED Y AT X	ACTUAL Y	PERCENTAGE DIFFERENCE
11.5094	24.3636	25.597	5.099999
58.38353	19.90074	19.556	-1.599999
126.5827	18.07146	17.183	-4.799999
215.9675	16.9077	17.12601	1.299999
284.4175	16.33752	16.021	-1.799999
348.9299	15.92664	16.272	2.2

F-15C/D

LEAST SQUARES ANALYSIS BASED ON THE UNIT CURVE THEORY

COMPUTED VALUE OF FIRST UNIT--A = 12.40981
REGRESSION SLOPE COEFFICIENT--B = 7.117808E-02
IMPROVEMENT CURVE PERCENTAGE = 105.0574
COEFFICIENT OF CORRELATION--R = .5082655
COEFFICIENT OF DETERMINATION--R2= .2583338
RESIDUAL SUM OF SQUARES = 82519

COMPUTED LOT MIDPOINT--X	CALCULATED Y AT X	ACTUAL Y	PERCENTAGE DIFFERENCE
37.97626	16.07649	17.24899	7.299999
134.7349	17.59288	15.588	-11.3
204.8029	18.12514	15.508	-14.3
256.2239	18.41644	17.66499	-4
295.304	18.60347	19.94299	7.2
332.8115	18.76247	19.308	2.9
370.3875	18.90587	21.95399	16.09999
412.311	19.05072	21.017	10.3

F-15E

LEAST SQUARES ANALYSIS BASED ON THE UNIT CURVE THEORY
COMPUTED VALUE OF FIRST UNIT--A = 25.60678
REGRESSION SLOPE COEFFICIENT--B =-7.128870E-02
IMPROVEMENT CURVE PERCENTAGE = 95.17873
COEFFICIENT OF CORRELATION--R =-.7988768
COEFFICIENT OF DETERMINATION--R2= .6382042
RESIDUAL SUM OF SQUARES = 36220

F-15E (Continued)

COMPUTED LOT MIDPOINT--X	CALCULATED Y AT X	ACTUAL Y	PERCENTAGE DIFFERENCE
22.52371	20.50816	20.54401	.2
94.03337	18.52176	19.203	3.7
178.1974	17.69664	17.608	-.4
274.9954	17.15767	16.175	-5.599999
371.3845	16.79405	16.041	-4.4
467.6082	16.52046	17.927	8.5

F-16A/B

LEAST SQUARES ANALYSIS BASED ON THE UNIT CURVE THEORY

COMPUTED VALUE OF FIRST UNIT--A = 25.66431
REGRESSION SLOPE COEFFICIENT--B =-.237665
IMPROVEMENT CURVE PERCENTAGE = 84.81168
COEFFICIENT OF CORRELATION--R =-.8540008
COEFFICIENT OF DETERMINATION--R2= .7293174
RESIDUAL SUM OF SQUARES = 142989

COMPUTED LOT MIDPOINT--X	CALCULATED Y AT X	ACTUAL Y	PERCENTAGE DIFFERENCE
35.53532	10.98479	10.14	-7.599999
171.6578	7.554897	7.74	2.5
333.2515	6.452901	8.04	24.59999
512.2395	5.826164	5.05	-13.2
664.3892	5.47695	5.13	-6.2

F-16E

LEAST SQUARES ANALYSIS BASED ON THE UNIT CURVE THEORY

COMPUTED VALUE OF FIRST UNIT--A = 11.67754
REGRESSION SLOPE COEFFICIENT--B =-7.443361E-03
IMPROVEMENT CURVE PERCENTAGE = 99.4854
COEFFICIENT OF CORRELATION--R =-7.927829E-02
COEFFICIENT OF DETERMINATION--R2= 6.285045E-03
RESIDUAL SUM OF SQUARES = 522731

COMPUTED LOT MIDPOINT--X	CALCULATED Y AT X	ACTUAL Y	PERCENTAGE DIFFERENCE
45.27696	11.35079	9.86	-13
187.9763	11.23115	10.58	-5.7
336.7356	11.18252	14.55	30.09999
518.7251	11.14662	11.93	7
735.5105	11.11768	11.28	1.5
953.0249	11.09626	11.02	-.6
1169.294	11.07939	10.88	-1.7
1384.781	11.06545	10.69	-3.299999
1600.829	11.05351	10.61	-3.9
1818.381	11.04303	10.54	-4.5

D.1.3 - Electronics Programs

ARC-109V

LEAST SQUARES ANALYSIS BASED ON THE UNIT CURVE THEORY

COMPUTED VALUE OF FIRST UNIT--A = 3.894364E-02
REGRESSION SLOPE COEFFICIENT--B =-4.451278E-02
IMPROVEMENT CURVE PERCENTAGE = 96.96172
COEFFICIENT OF CORRELATION--R =-.5162547
COEFFICIENT OF DETERMINATION--R2= .2665188
RESIDUAL SUM OF SQUARES = .114144

COMPUTED LOT MIDPOINT--X	CALCULATED Y AT X	ACTUAL Y	PERCENTAGE DIFFERENCE
2.200019	3.760055E-02	4.870000E-02	29.5
14.74637	3.454738E-02	3.930000E-02	13.8
63.66246	3.236985E-02	2.850000E-02	-11.9
209.7737	3.069651E-02	3.130000E-02	2
386.1826	2.987385E-02	3.030000E-02	1.4

ARC-54

LEAST SQUARES ANALYSIS BASED ON THE UNIT CURVE THEORY

COMPUTED VALUE OF FIRST UNIT--A = 3.984546E-02
REGRESSION SLOPE COEFFICIENT--B =-.1174924
IMPROVEMENT CURVE PERCENTAGE = 92.17883
COEFFICIENT OF CORRELATION--R =-.9507738
COEFFICIENT OF DETERMINATION--R2= .9039707
RESIDUAL SUM OF SQUARES = 6.143275

COMPUTED LOT MIDPOINT--X	CALCULATED Y AT X	ACTUAL Y	PERCENTAGE DIFFERENCE
312.9502	2.028521E-02	2.100000E-02	3.5
1300.869	1.715853E-02	1.650000E-02	-3.7
2406.991	1.596178E-02	1.640000E-02	2.7
3697.606	1.517663E-02	1.450000E-02	-4.4
4442.937	1.485270E-02	1.440000E-02	-2.9
6071.922	1.431749E-02	1.390000E-02	-2.799999
8986.043	1.367303E-02	1.430000E-02	4.599999

ASN-63

LEAST SQUARES ANALYSIS BASED ON THE UNIT CURVE THEORY

COMPUTED VALUE OF FIRST UNIT--A = .1698809
REGRESSION SLOPE COEFFICIENT--B = 1.445999E-02
IMPROVEMENT CURVE PERCENTAGE = 101.0074
COEFFICIENT OF CORRELATION--R = .1925311
COEFFICIENT OF DETERMINATION--R2= 3.706823E-02
RESIDUAL SUM OF SQUARES = 40.111

ASN-63 (Continued)

COMPUTED LOT MIDPOINT--X	CALCULATED Y AT X	ACTUAL Y	PERCENTAGE DIFFERENCE
290.8103	.1844031	.1866	1.2
854.6306	.1873001	.1744	-6.799999
1070.379	.1879108	.1769	-5.799999
1286.798	.1884117	.1817	-3.5
1404.959	.1886513	.1772	-6
1518.325	.1888631	.2189	15.9
1639.629	.189073	.1911	1.099999
1770.583	.1892834	.1917	1.299999
1873.239	.1894376	.2005	5.799999
1911.149	.1894925	.2145	13.2

ASN-70

LEAST SQUARES ANALYSIS BASED ON THE UNIT CURVE THEORY

COMPUTED VALUE OF FIRST UNIT--A = 3.319578E-02
REGRESSION SLOPE COEFFICIENT--B = 1.179882E-02
IMPROVEMENT CURVE PERCENTAGE = 100.8212
COEFFICIENT OF CORRELATION--R = .2913945
COEFFICIENT OF DETERMINATION--R2= 8.491069E-02
RESIDUAL SUM OF SQUARES = .024526

COMPUTED LOT MIDPOINT--X	CALCULATED Y AT X	ACTUAL Y	PERCENTAGE DIFFERENCE
57.46007	3.482100E-02	3.500000E-02	.5
267.6995	3.545897E-02	3.530000E-02	-.3
442.1846	3.566956E-02	3.420000E-02	-4
512.1365	3.573142E-02	3.560000E-02	-.3
554.8198	3.576520E-02	3.700000E-02	3.5
572.6523	3.577856E-02	3.990000E-02	11.5
577.7412	3.578230E-02	3.700000E-02	3.4
589.3301	3.579065E-02	4.270000E-02	19.29999

ASN-99

LEAST SQUARES ANALYSIS BASED ON THE UNIT CURVE THEORY

COMPUTED VALUE OF FIRST UNIT--A = 2.736311E-02
REGRESSION SLOPE COEFFICIENT--B = 9.229285E-02
IMPROVEMENT CURVE PERCENTAGE = 106.6063
COEFFICIENT OF CORRELATION--R = .4379001
COEFFICIENT OF DETERMINATION--R2= .1917565
RESIDUAL SUM OF SQUARES = 13.523

ASN-99 (Continued)

COMPUTED LOT MIDPOINT--X	CALCULATED Y AT X	ACTUAL Y	PERCENTAGE DIFFERENCE
61.39713	4.001277E-02	4.640000E-02	16
249.6166	4.554249E-02	4.040000E-02	-11.2
443.0579	4.801919E-02	4.130000E-02	-13.9
656.5735	4.979441E-02	4.330000E-02	-12.9
793.3577	5.067174E-02	5.700000E-02	12.5
841.1819	5.094621E-02	6.240000E-02	22.5
905.3252	5.129292E-02	6.349999E-02	23.79999
991.4741	5.172503E-02	6.840003E-02	32.2

CP-1035N

LEAST SQUARES ANALYSIS BASED ON THE UNIT CURVE THEORY

COMPUTED VALUE OF FIRST UNIT--A = .1015563
REGRESSION SLOPE COEFFICIENT--B = 3.562090E-02
IMPROVEMENT CURVE PERCENTAGE = 102.4998
COEFFICIENT OF CORRELATION--R = .3165473
COEFFICIENT OF DETERMINATION--R2= .1002021
RESIDUAL SUM OF SQUARES = 1.159020

COMPUTED LOT MIDPOINT--X	CALCULATED Y AT X	ACTUAL Y	PERCENTAGE DIFFERENCE
5.33789	.1077994	.1248	15.8
24.36729	.1137905	9.030002E-02	-20.5
60.96123	.1175687	.1236	5.099999
109.6394	.1200528	.1287	7.2
158.8466	.1216487	.131	7.7
223.2825	.1231332	.1154	-6.2

LANTIRN (Navigation Pod)

LEAST SQUARES ANALYSIS BASED ON THE UNIT CURVE THEORY

COMPUTED VALUE OF FIRST UNIT--A = 1.855365
REGRESSION SLOPE COEFFICIENT--B =-.117944
IMPROVEMENT CURVE PERCENTAGE = 92.14999
COEFFICIENT OF CORRELATION--R =-.999546
COEFFICIENT OF DETERMINATION--R2= .9990922
RESIDUAL SUM OF SQUARES = .399392

COMPUTED LOT MIDPOINT--X	CALCULATED Y AT X	ACTUAL Y	PERCENTAGE DIFFERENCE
2.17795	1.692616	1.75	3.4
18.47746	1.315335	1.3199	.3
98.29176	1.08	1.0761	-.3
244.5373	.9699255	.9679	-.1
390.0264	.9179633	.9184	0
534.6924	.8844348	.8854	.1
665.5452	.8618912	.8643	.3

LANTIRN (Target Pod)

LEAST SQUARES ANALYSIS BASED ON THE UNIT CURVE THEORY

COMPUTED VALUE OF FIRST UNIT--A = 1.551688
REGRESSION SLOPE COEFFICIENT--B =-.1095342
IMPROVEMENT CURVE PERCENTAGE = 92.68872
COEFFICIENT OF CORRELATION--R =-.999943
COEFFICIENT OF DETERMINATION--R2= .999886
RESIDUAL SUM OF SQUARES = .025503

COMPUTED LOT MIDPOINT--X	CALCULATED Y AT X	ACTUAL Y	PERCENTAGE DIFFERENCE
2.180472	1.424693	1.4375	.9
18.50204	1.127198	1.1286	.1
98.36555	.9386852	.9375	0
244.5715	.8495566	.849	0
390.0371	.8072159	.8081	.1
534.7092	.7797983	.7795	0
665.5884	.7613193	.7619	.1

LANTIRN (Target Recognizer)

LEAST SQUARES ANALYSIS BASED ON THE UNIT CURVE THEORY

COMPUTED VALUE OF FIRST UNIT--A = .7091457
REGRESSION SLOPE COEFFICIENT--B =-.1458758
IMPROVEMENT CURVE PERCENTAGE = 90.38304
COEFFICIENT OF CORRELATION--R =-.9967853
COEFFICIENT OF DETERMINATION--R2= .993581
RESIDUAL SUM OF SQUARES = 1.139542

COMPUTED LOT MIDPOINT--X	CALCULATED Y AT X	ACTUAL Y	PERCENTAGE DIFFERENCE
28.33714	.4353834	.4383	.7
164.6798	.3368071	.3353	-.3
362.6345	.3001724	.2975	-.8
556.3337	.2820054	.2865	1.599999
687.7212	.2734171	.2693	-1.4

ASQ-133

LEAST SQUARES ANALYSIS BASED ON THE UNIT CURVE THEORY

COMPUTED VALUE OF FIRST UNIT--A = .8637488
REGRESSION SLOPE COEFFICIENT--B =-.1669796
IMPROVEMENT CURVE PERCENTAGE = 89.07054
COEFFICIENT OF CORRELATION--R =-.9682331
COEFFICIENT OF DETERMINATION--R2= .9374753
RESIDUAL SUM OF SQUARES = 3.438142

ASQ-133 (Continued)

COMPUTED LOT MIDPOINT--X	CALCULATED Y AT X	ACTUAL Y	PERCENTAGE DIFFERENCE
5.760303	.6447756	.5856	-9.099999
23.24266	.5107939	.5862	14.8
63.95222	.4313665	.4255	-1.299999
133.3676	.3815465	.3828	.3
207.4631	.3544098	.3535	-.2
277.9119	.3375242	.3355	-.5

ASN-108

LEAST SQUARES ANALYSIS BASED ON THE UNIT CURVE THEORY

COMPUTED VALUE OF FIRST UNIT--A = .1218626
REGRESSION SLOPE COEFFICIENT--B =-5.392056E-02
IMPROVEMENT CURVE PERCENTAGE = 96.33148
COEFFICIENT OF CORRELATION--R =-.6751171
COEFFICIENT OF DETERMINATION--R2= .4557831
RESIDUAL SUM OF SQUARES = .950186

COMPUTED LOT MIDPOINT--X	CALCULATED Y AT X	ACTUAL Y	PERCENTAGE DIFFERENCE
3.720273	.1135284	.1373	20.89999
22.04295	.1031432	.1048	1.599999
74.46913	9.659004E-02	8.740002E-02	-9.4
214.8606	9.122610E-02	9.429997E-02	3.4
385.1765	8.839953E-02	8.719999E-02	-1.299999

ASW-32

LEAST SQUARES ANALYSIS BASED ON THE UNIT CURVE THEORY

COMPUTED VALUE OF FIRST UNIT--A = .2194301
REGRESSION SLOPE COEFFICIENT--B =-9.391868E-02
IMPROVEMENT CURVE PERCENTAGE = 93.69742
COEFFICIENT OF CORRELATION--R =-.4323077
COEFFICIENT OF DETERMINATION--R2= .1868899
RESIDUAL SUM OF SQUARES = 6.064086

COMPUTED LOT MIDPOINT--X	CALCULATED Y AT X	ACTUAL Y	PERCENTAGE DIFFERENCE
5.157684	.1880977	.2338	24.29999
24.21431	.1626694	.1643	1
60.76486	.1492031	.1524	2.099999
109.5462	.1411691	9.740001E-02	-30.89999
158.7936	.1363317	.1441	5.7
223.199	.1320414	.1518	15

JTIDS

LEAST SQUARES ANALYSIS BASED ON THE UNIT CURVE THEORY

COMPUTED VALUE OF FIRST UNIT--A = .7067251
REGRESSION SLOPE COEFFICIENT--B =-.2071212
IMPROVEMENT CURVE PERCENTAGE = 86.6264
COEFFICIENT OF CORRELATION--R =-.9947682
COEFFICIENT OF DETERMINATION--R2= .9895638
RESIDUAL SUM OF SQUARES = .6778845

COMPUTED LOT MIDPOINT--X	CALCULATED Y AT X	ACTUAL Y	PERCENTAGE DIFFERENCE
16.18355	.3970322	.4068	2.5
79.83911	.2852734	.2764	-3
158.117	.2476257	.2466	-.3
233.3872	.2284398	.2308	1
298.4558	.2170954	.2205	1.599999

D.1.4 - Helicopter Programs

HH-52

LEAST SQUARES ANALYSIS BASED ON THE UNIT CURVE THEORY

COMPUTED VALUE OF FIRST UNIT--A = 2.510573
REGRESSION SLOPE COEFFICIENT--B =-.2078822
IMPROVEMENT CURVE PERCENTAGE = 86.58072
COEFFICIENT OF CORRELATION--R =-.966575
COEFFICIENT OF DETERMINATION--R2= .9342672
RESIDUAL SUM OF SQUARES = 4.030276

COMPUTED LOT MIDPOINT--X	CALCULATED Y AT X	ACTUAL Y	PERCENTAGE DIFFERENCE
10.46474	1.540954	1.577	2.299999
35.68379	1.194103	1.104	-7.4
51.71971	1.105437	1.085	-1.7
67.83403	1.044834	1.012	-3
81.41185	1.005946	1.041	3.5
93.42331	.9775758	1.055	7.9

CH-46

LEAST SQUARES ANALYSIS BASED ON THE UNIT CURVE THEORY
COMPUTED VALUE OF FIRST UNIT--A = 7.059481
REGRESSION SLOPE COEFFICIENT--B =-.1983187
IMPROVEMENT CURVE PERCENTAGE = 87.15656
COEFFICIENT OF CORRELATION--R =-.7980223
COEFFICIENT OF DETERMINATION--R2= .6368395
RESIDUAL SUM OF SQUARES = 8777.386

CH-46 (Continued)

COMPUTED LOT MIDPOINT--X	CALCULATED Y AT X	ACTUAL Y	PERCENTAGE DIFFERENCE
5.705781	4.997828	7.541	50.89999
30.34441	3.587971	3.898	8.599999
78.19377	2.973866	2.766	-6.9
150.6072	2.611351	2.419	-7.299999
288.1113	2.296128	1.986	-13.4
439.5525	2.111614	2.236	5.9
530.7312	2.034133	2.37	16.5
600.3086	1.985041	2.547	28.29999

H-53

LEAST SQUARES ANALYSIS BASED ON THE UNIT CURVE THEORY

COMPUTED VALUE OF FIRST UNIT--A = 7.528306
REGRESSION SLOPE COEFFICIENT--B =-.1327494
IMPROVEMENT CURVE PERCENTAGE = 91.20915
COEFFICIENT OF CORRELATION--R =-.9476063
COEFFICIENT OF DETERMINATION--R2= .8979577
RESIDUAL SUM OF SQUARES = 300.4416

COMPUTED LOT MIDPOINT--X	CALCULATED Y AT X	ACTUAL Y	PERCENTAGE DIFFERENCE
4.381923	6.187521	6.752	9.099999
62.34674	4.349475	4.264	-1.9
207.0168	3.708932	3.762	1.4
287.5083	3.550691	3.382	-4.7
308.3904	3.517797	3.341	-4.9
327.5176	3.489806	3.154	-9.5
346.3867	3.463953	3.685	6.4
364.5776	3.440497	3.947	14.7

CH-47

LEAST SQUARES ANALYSIS BASED ON THE UNIT CURVE THEORY

COMPUTED VALUE OF FIRST UNIT--A = 7.26133
REGRESSION SLOPE COEFFICIENT--B =-.1667243
IMPROVEMENT CURVE PERCENTAGE = 89.0863
COEFFICIENT OF CORRELATION--R =-.6538081
COEFFICIENT OF DETERMINATION--R2= .427465
RESIDUAL SUM OF SQUARES = 14163

CH-47 (Continued)

COMPUTED LOT MIDPOINT--X	CALCULATED Y AT X	ACTUAL Y	PERCENTAGE DIFFERENCE
7.163215	5.229363	6.181	18.2
29.54865	4.12897	5.226	26.59999
53.98152	3.734296	4.559	22.09999
94.65002	3.400546	3.459	1.7
160.9409	3.112513	2.76	-11.2
273.9456	2.848382	2.307	-18.89999
399.6489	2.674563	2.313	-13.4
512.0642	2.566291	2.695	5
607.8618	2.493952	3.463	38.89999
648.459	2.467216	3.085	25
672.4001	2.452348	3.671	49.7
684.364	2.445146	3.852	57.5

H-54

LEAST SQUARES ANALYSIS BASED ON THE UNIT CURVE THEORY

COMPUTED VALUE OF FIRST UNIT--A = 5.042629
REGRESSION SLOPE COEFFICIENT--B =-.124368
IMPROVEMENT CURVE PERCENTAGE = 91.74057
COEFFICIENT OF CORRELATION--R =-.7003797
COEFFICIENT OF DETERMINATION--R2= .4905316
RESIDUAL SUM OF SQUARES = 266.129

COMPUTED LOT MIDPOINT--X	CALCULATED Y AT X	ACTUAL Y	PERCENTAGE DIFFERENCE
2.925361	4.412444	5.248	18.89999
16.87009	3.548484	3.388	-4.4
44.55142	3.144788	2.801	-10.8
71.6548	2.964312	3.402	14.8
86.48141	2.895782	3.083	6.5

HH-60D

LEAST SQUARES ANALYSIS BASED ON THE UNIT CURVE THEORY

COMPUTED VALUE OF FIRST UNIT--A = 8.655892
REGRESSION SLOPE COEFFICIENT--B =-6.608355E-02
IMPROVEMENT CURVE PERCENTAGE = 95.52275
COEFFICIENT OF CORRELATION--R =-.9207171
COEFFICIENT OF DETERMINATION--R2= .84772
RESIDUAL SUM OF SQUARES = 35.323

COMPUTED LOT MIDPOINT--X	CALCULATED Y AT X	ACTUAL Y	PERCENTAGE DIFFERENCE
1.804782	8.324657	9.2	10.5
13.93048	7.273015	7.1	-2.299999
44.77992	6.732903	6.7	-.4
77.521	6.493103	6.6	1.599999

SH-3

LEAST SQUARES ANALYSIS BASED ON THE UNIT CURVE THEORY

COMPUTED VALUE OF FIRST UNIT--A = 4.767113
REGRESSION SLOPE COEFFICIENT--B =-.1723884
IMPROVEMENT CURVE PERCENTAGE = 88.73723
COEFFICIENT OF CORRELATION--R =-.8774585
COEFFICIENT OF DETERMINATION--R2= .7699333
RESIDUAL SUM OF SQUARES = 426.35

COMPUTED LOT MIDPOINT--X	CALCULATED Y AT X	ACTUAL Y	PERCENTAGE DIFFERENCE	
7.84527	3.342222	3.327	-.4	
42.18849	2.500868	2.48	-.7	
102.595	2.145658	2.319		8.099999
162.3942	1.982342	1.811	-8.5	
203.1902	1.907215	1.87	-1.9	
239.2339	1.854274	1.589	-14.2	
272.3391	1.813304	1.703	-6	
311.1265	1.772156	1.93		8.9
342.9824	1.742625	2.144		23

D.1.5 - Tactical Armaments Programs

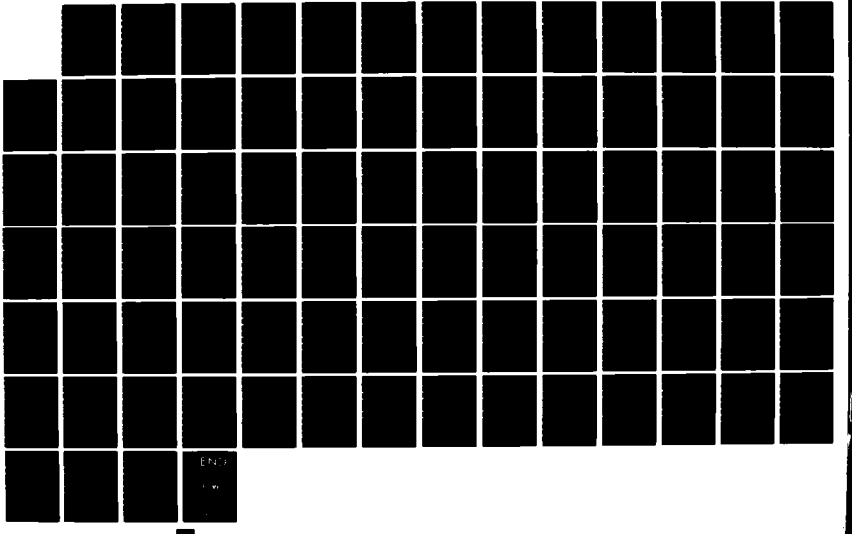
LLLGB

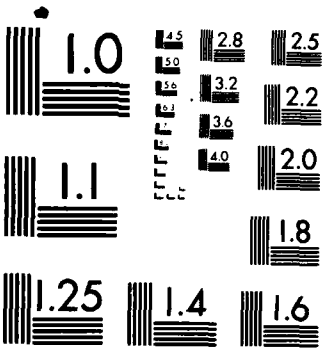
LEAST SQUARES ANALYSIS BASED ON THE UNIT CURVE THEORY

COMPUTED VALUE OF FIRST UNIT--A = 8.167720E-02
REGRESSION SLOPE COEFFICIENT--B =-.1711348
IMPROVEMENT CURVE PERCENTAGE = 88.81438
COEFFICIENT OF CORRELATION--R =-.9991233
COEFFICIENT OF DETERMINATION--R2= .9982474
RESIDUAL SUM OF SQUARES = 7277633

COMPUTED LOT MIDPOINT--X	CALCULATED Y AT X	ACTUAL Y	PERCENTAGE DIFFERENCE	
537.4834	2.785097E-02	2.750000E-02	-1.2	
2929.215	2.083624E-02	2.060000E-02	-1	
6311.996	1.827090E-02	1.890000E-02		3.4
12463.21	1.626283E-02	1.620000E-02	-.3	
21873.7	1.477030E-02	1.470000E-02	-.4	
33790.39	1.371092E-02	1.370000E-02		0
48846.61	1.287295E-02	1.290000E-02		.2
64505.62	1.227470E-02	1.230000E-02		.2
80139.94	1.182718E-02	1.180000E-02	-.1	
93973.44	1.150924E-02	1.150000E-02		0

AD-A162 260 EVALUATION OF THE AIR FORCE SYSTEMS COMMAND PRODUCTION 2/2
RATE MODEL AND ALT (U) AIR FORCE INST OF TECH
WRIGHT-PATTERSON AFB OH SCHOOL OF SYST H K BOLTON
UNCLASSIFIED SEP 85 AFIT/GSM/LSQ/85S-3 F/G 5/1 NL





MICROCOPY RESOLUTION TEST CHART
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CEM

LEAST SQUARES ANALYSIS BASED ON THE UNIT CURVE THEORY

COMPUTED VALUE OF FIRST UNIT--A = 9.010392E-02
REGRESSION SLOPE COEFFICIENT--B =-.1688958
IMPROVEMENT CURVE PERCENTAGE = 88.95232
COEFFICIENT OF CORRELATION--R =-.9792723
COEFFICIENT OF DETERMINATION--R2= .9589742
RESIDUAL SUM OF SQUARES = 893775690

COMPUTED LOT MIDPOINT--X	CALCULATED Y AT X	ACTUAL Y	PERCENTAGE DIFFERENCE
59.4463	4.519615E-02	6.923997E-02	53.2
685.9932	2.990207E-02	3.038000E-02	1.599999
4031.828	2.217123E-02	1.988000E-02	-10.2
13955.02	1.797696E-02	1.765000E-02	-1.7
34864.74	1.540116E-02	1.619000E-02	5.099999
66842.44	1.379788E-02	1.401000E-02	1.5
108627.9	1.271142E-02	1.258000E-02	-.9
152464.1	1.200406E-02	1.181000E-02	-1.5

GBU-15

LEAST SQUARES ANALYSIS BASED ON THE UNIT CURVE THEORY

COMPUTED VALUE OF FIRST UNIT--A = .1821983
REGRESSION SLOPE COEFFICIENT--B =-2.617976E-02
IMPROVEMENT CURVE PERCENTAGE = 98.20172
COEFFICIENT OF CORRELATION--R =-.2818831
COEFFICIENT OF DETERMINATION--R2= 7.945806E-02
RESIDUAL SUM OF SQUARES = 284882710

COMPUTED LOT MIDPOINT--X	CALCULATED Y AT X	ACTUAL Y	PERCENTAGE DIFFERENCE
15.61668	.1695495	.1975	16.5
70.42491	.1629938	.2	22.7
255.7521	.1575825	.1439	-8.599999
565.7703	.1543408	.1483	-3.799999
850.3901	.152703	.1308	-14.2
1303.809	.1510041	.1718	13.8
1907.187	.1495079	.1539	2.9
2508.986	.1484383	.1483	0
3110.912	.1476051	.142	-3.7

D.1.6 - Tactical Missile Programs

AMRAAM

LEAST SQUARES ANALYSIS BASED ON THE UNIT CURVE THEORY

COMPUTED VALUE OF FIRST UNIT--A = 4.665209
REGRESSION SLOPE COEFFICIENT--B =-.3410547
IMPROVEMENT CURVE PERCENTAGE = 78.94638
COEFFICIENT OF CORRELATION--R =-.9978255
COEFFICIENT OF DETERMINATION--R2= .9956557
RESIDUAL SUM OF SQUARES = 1938

COMPUTED LOT MIDPOINT--X	CALCULATED Y AT X	ACTUAL Y	PERCENTAGE DIFFERENCE
60.33484	1.15239	1.233	7
621.0952	.5202968	.512	-1.5
2131.998	.3416431	.342	.1
4604.375	.2627422	.257	-2.099999
7599.523	.2214679	.232	4.799999
10516.86	.1982385	.194	-2
13426.46	.1823938	.182	-.1
16381.14	.1704312	.17	-.2
19385.29	.1609195	.158	-1.7
22757.82	.152353	.155	1.7

HARM

LEAST SQUARES ANALYSIS BASED ON THE UNIT CURVE THEORY

COMPUTED VALUE OF FIRST UNIT--A = 1.412584
REGRESSION SLOPE COEFFICIENT--B =-.2171178
IMPROVEMENT CURVE PERCENTAGE = 86.02823
COEFFICIENT OF CORRELATION--R =-.9767144
COEFFICIENT OF DETERMINATION--R2= .953971
RESIDUAL SUM OF SQUARES = 2435

COMPUTED LOT MIDPOINT--X	CALCULATED Y AT X	ACTUAL Y	PERCENTAGE DIFFERENCE
27.69743	.6868075	.809	17.79999
182.8538	.4559019	.517	13.4
498.4702	.3666983	.4	9.099999
1032.749	.3130563	.314	.3
2201.524	.2656132	.249	-6.2
4306.594	.2296039	.223	-2.799999
6637.656	.2090195	.208	-.4
8771.254	.1967458	.197	.1
11323.17	.186134	.184	-1
14331.46	.1768519	.177	.1
16408.41	.1717309	.196	14.1

IIR-Maverick

LEAST SQUARES ANALYSIS BASED ON THE UNIT CURVE THEORY

COMPUTED VALUE OF FIRST UNIT--A = .381235
REGRESSION SLOPE COEFFICIENT--B =-.1838619
IMPROVEMENT CURVE PERCENTAGE = 88.03432
COEFFICIENT OF CORRELATION--R =-.9356945
COEFFICIENT OF DETERMINATION--R2= .8755241
RESIDUAL SUM OF SQUARES = 8259

COMPUTED LOT MIDPOINT--X	CALCULATED Y AT X	ACTUAL Y	PERCENTAGE DIFFERENCE
68.31573	.1753454	.309	76.2
580.1086	.1183283	.135	14.1
2250.598	9.222162E-02	8.300000E-02	-9.9
6306.387	7.630587E-02	8.200002E-02	7.5
13635.26	6.621945E-02	6.200000E-02	-6.299999
24134.33	5.962016E-02	5.700000E-02	-4.299999
36233.79	5.532806E-02	5.500000E-02	-.5
48283.65	5.248320E-02	5.300000E-02	1
57511.69	5.082235E-02	5.700000E-02	12.2

AIM-7F (Raytheon)

LEAST SQUARES ANALYSIS BASED ON THE UNIT CURVE THEORY

COMPUTED VALUE OF FIRST UNIT--A = 2.375205
REGRESSION SLOPE COEFFICIENT--B =-.3703166
IMPROVEMENT CURVE PERCENTAGE = 77.36127
COEFFICIENT OF CORRELATION--R =-.9899639
COEFFICIENT OF DETERMINATION--R2= .9800286
RESIDUAL SUM OF SQUARES = 424

COMPUTED LOT MIDPOINT--X	CALCULATED Y AT X	ACTUAL Y	PERCENTAGE DIFFERENCE
31.44672	.6624059	.741	11.9
198.3586	.3349016	.378	12.9
590.5605	.223592	.199	-10.9
1297.295	.1670673	.169	1.2
2244.682	.1363682	.134	-1.599999
3493.429	.1157648	.116	.2
4665.543	.104003	.111	6.7
5684.336	9.666765E-02	9.500003E-02	-1.599999

AIM-7F (General Dynamics)

LEAST SQUARES ANALYSIS BASED ON THE UNIT CURVE THEORY
COMPUTED VALUE OF FIRST UNIT--A = 2.190674
REGRESSION SLOPE COEFFICIENT--B =-.4225164
IMPROVEMENT CURVE PERCENTAGE = 74.6122
COEFFICIENT OF CORRELATION--R =-.9906843
RESIDUAL SUM OF SQUARES = 173

AIM-7F (Continued)

COEFFICIENT OF DETERMINATION--R2= .9814553

COMPUTED LOT MIDPOINT--X	CALCULATED Y AT X	ACTUAL Y	PERCENTAGE DIFFERENCE
5.620054	1.056331	1.551	46.79999
43.8376	.4434765	.379	-14.4
175.5641	.2467555	.228	-7.5
393.8618	.175389	.195	11.2
840.7761	.127307	.13	2.099999
1855.622	9.111446E-02	8.999997E-02	-1.099999

D.2 - TASC Formulation, SAS Runs

This section contains summary results produced using the Statistical Analysis System (SAS) nonlinear curve fitting procedure PROC NLIN on the TASC formulation. The program used to generate these results was discussed in Appendix C. Access to SAS was gained through the Boeing Computer Services system.

D.2.1 - Bomber Aircraft Programs

B-1B

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	3	59465525.34852517	19821841.78284172
RESIDUAL	2	12451.46147482	6225.73073741
UNCORRECTED TOTAL	5	59477976.80999999	
(CORRECTED TOTAL)	4	17234615.03200000	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	438.08000384	35.94026138	273.43984119	582.72016650
B	-0.24741601	0.04840000	-0.45566670	-0.03916531
C	-0.07035048	0.06955249	-0.36961400	0.22891304

LOT	XL	XU	YI	AUC	UCP	DIF	PCT	SB	SC
1	0	1	1	535.8	568.811	-33.011	-6.1610	0.842404	0.952407
2	1	8	7	260.3	268.036	-7.736	-2.9719		
3	8	18	10	200.5	194.559	5.941	2.9630		
4	18	52	34	142.0	140.446	1.554	1.0942		
5	52	100	48	111.3	112.257	-0.957	-0.8597		

B-52

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	3	69952561.61267929	23317520.53755976
RESIDUAL	7	2448210.29732068	349744.32818867
UNCORRECTED TOTAL	10	72400771.90999997	
(CORRECTED TOTAL)	9	18070289.98900000	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	133.32076505	75.91752000	-46.19708501	312.83861512
B	-0.13928226	0.09677367	-0.36811747	0.08955294
C	-0.15337667	0.14249507	-0.49032668	0.18357335

LOT	XL	XU	YI	AUC	UCP	DIF	PCT	SB	SC
1	0	20	20	112.5	64.4583	48.042	42.704	0.907971	0.899144
2	20	63	43	37.0	44.9148	-7.915	-21.391		
3	63	88	25	28.6	44.5902	-15.990	-55.910		
4	88	165	77	32.3	34.9838	-2.684	-8.309		
5	165	298	133	23.4	29.5653	-6.165	-26.348		
6	298	500	202	28.4	25.6917	2.708	9.536		
7	500	601	101	27.3	27.2797	0.020	0.074		
8	601	640	39	27.3	31.0383	-3.738	-13.693		
9	640	702	62	35.4	28.5956	6.804	19.222		
10	702	742	40	35.0	30.2722	4.728	13.508		

B-58

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	3	13754942.42043127	4584980.80681042
RESIDUAL	1	483386.45356873	483386.45356873
UNCORRECTED TOTAL	4	14238328.87400000	
(CORRECTED TOTAL)	3	1830393.07390000	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	55.09536676	128.58157264	-1578.66209519	1688.85282871
B	-0.31105765	0.24854601	-3.46908321	2.84696790
C	0.39183296	0.83857210	-10.26306417	11.04673009

LOT	XL	XU	YI	AUC	UCP	DIF	PCT	SB	SC
1	0	17	17	93.86	100.536	-6.676	-7.113	0.806051	1.31206
2	17	53	36	80.26	75.732	4.528	5.642		
3	53	73	20	73.16	49.199	23.961	32.752		
4	73	103	30	36.56	51.990	-15.430	-42.205		

D.2.2 - Fighter Aircraft Programs

A-10

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	3	5178313.38076423	1726104.46025474
RESIDUAL	6	8904.00363577	1484.00060596
UNCORRECTED TOTAL	9	5187217.38440000	
(CORRECTED TOTAL)	8	1226666.30488889	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL	
			LOWER	UPPER
A	21.44985222	4.03343987	11.58037328	31.31933116
B	0.03113150	0.02584859	-0.03211777	0.09438078
C	-0.24204629	0.04368475	-0.34893910	-0.13515348

LOT	XL	XU	YI	AUC	UCP	DIF	PCT	SB	SC
1	0	22	22	12.37	10.8386	1.5314	12.380	1.02181	0.845545
2	22	75	53	9.16	9.2434	-0.0834	-0.910		
3	75	95	20	8.20	11.9275	-3.7275	-45.458		
4	95	195	100	8.20	8.2101	-0.0101	-0.123		
5	195	339	144	7.82	7.6627	0.1573	2.012		
6	339	483	144	7.59	7.7679	-0.1779	-2.344		
7	483	627	144	7.82	7.8415	-0.0215	-0.275		
8	627	687	60	10.18	9.7441	0.4359	4.282		
9	687	707	20	13.64	12.7359	0.9041	6.629		

F-100

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	3	11794925.06962558	3931641.68987519
RESIDUAL	2	40715.79937442	20357.89968721
UNCORRECTED TOTAL	5	11835640.86900000	
(CORRECTED TOTAL)	4	2086478.76652000	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL	
			LOWER	UPPER
A	8.62607228	17.50465792	-66.69121935	83.94336392
B	-0.11213233	0.04959475	-0.32552365	0.10125899
C	-0.04584550	0.33200055	-1.47434427	1.38265326

LOT	XL	XU	YI	AUC	UCP	DIF	PCT	SB	SC
1	0	23	23	6.51	5.92028	0.58972	9.059	0.92522	0.968722
2	23	568	545	3.45	3.50879	-0.05879	-1.704		
3	568	1161	593	3.08	3.02328	0.05672	1.841		
4	1161	1720	559	3.10	2.85778	0.24222	7.813		
5	1720	2277	557	2.50	2.75416	-0.25416	-10.166		

F-101

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	3	7053013.435[illegible]7860	2351004.47789287
RESIDUAL	3	23846.41092140	7948.80364047
UNCORRECTED TOTAL	6	7076859.84460000	
(CORRECTED TOTAL)	5	2200718.46433334	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	20.96218896	7.28271212	-2.21504237	44.13942029
B	-0.23865486	0.04915003	-0.39507483	-0.08223489
C	0.03547276	0.07051367	-0.18893700	0.25988252

LOT	XL	XU	YI	AUC	UCP	DIF	PCT	SB	SC
1	0	31	31	16.85	13.7037	3.1463	18.673	0.847535	1.02489
2	31	115	84	7.58	8.9754	-1.3954	-18.408		
3	115	424	309	6.91	6.8814	0.0286	0.413		
4	424	630	206	5.76	5.6855	0.0745	1.293		
5	630	714	84	5.27	5.1882	0.0818	1.553		
6	714	807	93	5.22	5.0554	0.1646	3.153		

F-102

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	3	4462098.32749172	1487366.10916391
RESIDUAL	1	608.13850828	608.13850828
UNCORRECTED TOTAL	4	4462706.46600000	
(CORRECTED TOTAL)	3	1795723.51790000	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	18.63555645	2.06898030	-7.65290718	44.92402009
B	-0.42718460	0.02992950	-0.80746877	-0.04690043
C	0.13580105	0.03804008	-0.34753620	0.61913829

LOT	XL	XU	YI	AUC	UCP	DIF	PCT	SB	SC
1	0	37	37	11.66	11.3599	0.30011	2.5738	0.743712	1.0987
2	37	145	108	5.17	5.3413	-0.17133	-3.3139		
3	145	707	562	3.50	3.4978	0.00224	0.0640		
4	707	847	140	2.21	2.1252	0.08478	3.8360		

F-106

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	3	4718019.71383912	1572673.23794637
RESIDUAL	1	47059.15946088	47059.15946088
UNCORRECTED TOTAL	4	4765078.87330000	
(CORRECTED TOTAL)	3	480903.34267500	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	139.14562626	195.51878771	-2345.11609043	2623.40734295
B	-0.45692467	0.16571227	-2.56246482	1.64861548
C	-0.08981313	0.45066476	-5.81595959	5.63633332

LOT	XL	XU	YI	AUC	UCP	DIF	PCT	SB	SC
1	0	42	42	34.19	33.1978	0.9922	2.902	0.728538	0.939644
2	42	130	88	10.54	12.5590	-2.0190	-19.155		
3	130	175	45	11.64	9.9645	1.6755	14.394		
4	175	340	165	7.59	7.0455	0.5445	7.174		

F-15A/B

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	3	10241181.29974886	3413727.09991629
RESIDUAL	3	6603.28516010	2201.09505337
UNCORRECTED TOTAL	6	10247784.58490896	
(CORRECTED TOTAL)	5	1585922.13232014	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	29.32544913	6.44803681	8.80457198	49.84632628
B	-0.12905905	0.03113285	-0.22813934	-0.02997876
C	0.03211433	0.07566158	-0.20867865	0.27290731

LOT	XL	XU	YI	AUC	UCP	DIF	PCT	SB	SC
1	0	30	30	25.5970	24.2135	1.38354	5.4051	0.914428	1.02251
2	30	92	62	19.5560	19.8325	-0.27650	-1.4139		
3	92	164	72	17.1838	18.0216	-0.83781	-4.8756		
4	164	272	108	17.1260	17.0376	0.08841	0.5163		
5	272	296	24	16.0210	15.6663	0.35475	2.2143		
6	296	404	108	16.2720	16.0127	0.25929	1.5935		

F-15C/D

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	3	8367698.17909118	2789232.72636373
RESIDUAL	5	51443.10728890	10288.62145778
UNCORRECTED TOTAL	8	8419141.28638009	
(CORRECTED TOTAL)	7	752329.31026303	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	165.24115178	217.33829503	-393.43662408	723.91892763
B	-0.10038305	0.08572069	-0.32073190	0.11996579
C	-0.42185403	0.22329603	-0.99584643	0.15213837

LOT	XL	XU	YI	AUC	UCP	DIF	PCT	SB	SC
1	0	97	97	17.2499	16.8459	0.4040	2.342	0.932785	0.746465
2	97	175	78	15.5880	16.0855	-0.4975	-3.192		
3	175	235	60	15.5080	17.2230	-1.7150	-11.059		
4	235	277	42	17.6650	19.5727	-1.9077	-10.799		
5	277	313	36	19.9430	20.5915	-0.6485	-3.252		
6	313	352	39	19.3080	19.6700	-0.3620	-1.875		
7	352	388	36	21.9540	20.1280	1.8260	8.317		
8	388	436	48	21.0170	17.6366	3.3804	16.084		

F-15E

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	3	14006776.74018744	4668925.58006248
RESIDUAL	3	25999.79645256	8666.59881752
UNCORRECTED TOTAL	6	14032776.53664000	
(CORRECTED TOTAL)	5	172346.38665600	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	112.24798192	164.76085479	-412.10343845	636.59940229
B	-0.00094521	0.07322907	-0.23399673	0.23210632
C	-0.41307128	0.40654604	-1.70690404	0.88076148

LOT	XL	XU	YI	AUC	UCP	DIF	PCT	SB	SC
1	0	60	60	20.544	20.6255	-0.08154	-0.3969	0.999345	0.751023
2	60	132	72	19.203	19.1031	0.09988	0.5201		
3	132	228	96	17.608	16.9525	0.65555	3.7230		
4	228	324	96	16.175	16.9455	-0.77049	-4.7635		
5	324	420	96	16.041	16.9407	-0.89967	-5.6086		
6	420	516	96	17.927	16.9370	0.99002	5.5225		

F-16A/B

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	3	5492587.88936737	1830862.62978912
RESIDUAL	2	85448.85063263	42724.42531632
UNCORRECTED TOTAL	5	5578036.74000000	
(CORRECTED TOTAL)	4	338023.54800000	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	2.96985658	9.97125974	-39.93348270	45.87319586
B	-0.28228778	0.15081916	-0.93121736	0.36664180
C	0.48163772	0.80210283	-2.96957014	3.93284557

LOT	XL	XU	YI	AUC	UCP	DIF	PCT	SB	SC
1	0	105	105	10.14	10.4643	-0.3243	-3.198	0.822286	1.39633
2	105	250	145	7.74	7.6464	0.0936	1.209		
3	250	425	175	8.04	6.9370	1.1030	13.719		
4	425	605	180	5.05	6.2267	-1.1767	-23.301		
5	605	725	120	5.13	4.7590	0.3710	7.232		

F-16E

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	3	47669177.61687108	15889725.87229036
RESIDUAL	7	347668.00592890	49666.85798984
UNCORRECTED TOTAL	10	48016845.62279998	
(CORRECTED TOTAL)	9	1747028.76516001	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	15.20770586	26.15145864	-46.63116388	77.04657561
B	-0.01449910	0.07790529	-0.19871732	0.16971912
C	-0.04040851	0.40664858	-1.00198733	0.92117031

LOT	XL	XU	YI	AUC	UCP	DIF	PCT	SB	SC
1	0	120	120	9.86	11.8643	-2.0043	-20.328	0.99	0.97238
2	120	264	144	10.58	11.5318	-0.9518	-8.997		
3	264	414	150	14.55	11.4156	3.1344	21.542		
4	414	630	216	11.93	11.1783	0.7517	6.301		
5	630	846	216	11.28	11.1217	0.1583	1.403		
6	846	1062	216	11.02	11.0801	-0.0601	-0.546		
7	1062	1278	216	10.88	11.0473	-0.1673	-1.537		
8	1278	1494	216	10.69	11.0201	-0.3301	-3.088		
9	1494	1710	216	10.61	10.9969	-0.3869	-3.647		
10	1710	1926	216	10.54	10.9768	-0.4368	-4.144		

D.2.3 - Electronics Programs

ARC-109V

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	3	66.65025059	22.21675020
RESIDUAL	2	0.09382314	0.04691157
UNCORRECTED TOTAL	5	66.74407373	
(CORRECTED TOTAL)	4	29.01018283	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	0.03115175	0.01132816	-0.01758993	0.07989342
B	-0.00121346	0.05716290	-0.24716826	0.24474134
C	-0.00000000	0.06826021	-0.29370318	0.29370318

LOT	XL	XU	YI	AUC	UCP	DIF	PCT	SB	SC
1	0	4	4	0.0487	0.0311372	0.0175628	36.0633	0.999159	1
2	4	28	24	0.0393	0.0310515	0.0082485	20.9886		
3	28	107	79	0.0285	0.0309953	-0.0024953	-8.7556		
4	107	333	226	0.0313	0.0309503	0.0003497	1.1172		
5	333	441	108	0.0303	0.0309274	-0.0006274	-2.0708		

ARC-54

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	3	4659.58993138	1553.19664379
RESIDUAL	4	6.61101132	1.65275283
UNCORRECTED TOTAL	7	4666.20094270	
(CORRECTED TOTAL)	6	1109.40696153	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	0.03688649	0.01224601	0.00288657	0.07088642
B	-0.12812502	0.03503452	-0.22539512	-0.03085492
C	0.02202571	0.06787233	-0.16641553	0.21046695

LOT	XL	XU	YI	AUC	UCP	DIF	PCT	SB	SC
1	0	900	900	0.0210	0.0205575	0.00044251	2.1072	0.91502	1.01538
2	900	1753	853	0.0165	0.0170784	-0.00057836	-3.5052		
3	1753	3134	1381	0.0164	0.0159515	0.00044852	2.7349		
4	3134	4294	1160	0.0145	0.0150396	-0.00053957	-3.7212		
5	4294	4594	300	0.0144	0.0142583	0.00014167	0.9838		
6	4594	7697	3103	0.0139	0.0144228	-0.00052276	-3.7608		
7	7697	10347	2650	0.0143	0.0136685	0.00063150	4.4161		

ASN-63

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	3	27709.52344396	9236.50781465
RESIDUAL	7	32.44155215	4.63450745
UNCORRECTED TOTAL	10	27741.96499611	
(CORRECTED TOTAL)	9	14794.09415689	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL	
			LOWER	UPPER
A	0.27140167	0.24426932	-0.30620813	0.84901147
B	-0.03104719	0.07442492	-0.20703558	0.14494119
C	-0.03029350	0.07334683	-0.20373259	0.14314559

LOT	XL	XU	YI	AUC	UCP	DIF	PCT	SB	SC
1	0	781	781	0.1866	0.186154	0.000446	0.2389	0.97871	0.979221
2	781	930	149	0.1744	0.189130	-0.014730	-8.4459		
3	930	1217	287	0.1769	0.184119	-0.007219	-4.0808		
4	1217	1358	141	0.1817	0.187052	-0.005352	-2.9457		
5	1358	1450	92	0.1772	0.188977	-0.011777	-6.6459		
6	1450	1585	135	0.2189	0.186345	0.032555	14.8723		
7	1585	1693	108	0.1911	0.187159	0.003941	2.0620		
8	1693	1851	158	0.1917	0.184568	0.007132	3.7204		
9	1851	1887	36	0.2005	0.192705	0.007795	3.8879		
10	1887	1923	36	0.2145	0.192591	0.021909	10.2141		

ASN-70

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	3	119.43754853	39.81251618
RESIDUAL	5	0.01845028	0.00369006
UNCORRECTED TOTAL	8	119.45599881	
(CORRECTED TOTAL)	7	64.18968336	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL	
			LOWER	UPPER
A	0.03453007	0.00257126	0.02792052	0.04113961
B	0.00358189	0.00769788	-0.01620586	0.02336964
C	-0.00000000	0.01209254	-0.03108442	0.03108442

ASN-70 (Continued)

LOT	XL	XU	YI	AUC	UCP	DIF	PCT	SB	SC
1	0	152	152	0.0350	0.0350316	-0.0000316	-0.0902	1.00249	1
2	152	402	250	0.0353	0.0352282	0.0000718	0.2035		
3	402	483	81	0.0342	0.0352917	-0.0010917	-3.1921		
4	483	541	58	0.0356	0.0353103	0.0002897	0.8139		
5	541	567	26	0.0370	0.0353203	0.0016797	4.5398		
6	567	575	8	0.0399	0.0353241	0.0045759	11.4684		
7	575	583	8	0.0370	0.0353259	0.0016741	4.5246		
8	583	594	11	0.0427	0.0353279	0.0073721	17.2648		

ASN-99

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	3	379.19816989	126.39938996
RESIDUAL	5	4.40543925	0.88108785
UNCORRECTED TOTAL	8	383.60360914	
(CORRECTED TOTAL)	7	61.21154176	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL	
			LOWER	UPPER
A	0.15483868	0.11304126	-0.13573891	0.44541628
B	0.06502448	0.05977418	-0.08862770	0.21867666
C	-0.30979529	0.11132150	-0.59595217	-0.02363842

LOT	XL	XU	YI	AUC	UCP	DIF	PCT	SB	SC
1	0	157	157	0.0464	0.0421723	0.004228	9.111	1.0461	0.806756
2	157	353	196	0.0404	0.0432069	-0.002807	-6.948		
3	353	538	185	0.0413	0.0456634	-0.004363	-10.565		
4	538	781	243	0.0433	0.0430524	0.000248	0.572		
5	781	805	24	0.0570	0.0892934	-0.032293	-56.655		
6	805	877	72	0.0624	0.0637767	-0.001377	-2.206		
7	877	933	56	0.0635	0.0692707	-0.005771	-9.088		
8	933	1050	117	0.0684	0.0554603	0.012940	18.918		

CP-1035N

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	3	208.34675493	69.44891831
RESIDUAL	3	0.90139727	0.30046576
UNCORRECTED TOTAL	6	209.24815220	
(CORRECTED TOTAL)	5	41.36682739	

CP-1035N (Continued)

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	0.19112300	0.10910601	-0.15610687	0.53835287
B	0.14507928	0.13670360	-0.28997992	0.58013848
C	-0.28794452	0.27269260	-1.15578871	0.57989967

LOT	XL	XU	YI	AUC	UCP	DIF	PCT	SB	SC
1	0	12	12	0.1248	0.117031	0.007769	6.225	1.10579	0.819068
2	12	38	26	0.0903	0.118592	-0.028292	-31.332		
3	38	86	48	0.1236	0.113722	0.009878	7.992		
4	86	134	48	0.1287	0.123862	0.004838	3.759		
5	134	184	50	0.1310	0.129199	0.001801	1.375		
6	184	264	80	0.1154	0.118580	-0.003180	-2.756		

LANTIRN (Navigation Pod)

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	3	87339.18891700	29113.06297233
RESIDUAL	4	0.04197892	0.01049473
UNCORRECTED TOTAL	7	87339.23089592	
(CORRECTED TOTAL)	6	17386.82280392	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	1.87169188	0.01354405	1.83408806	1.90929569
B	-0.11470713	0.00047805	-0.11603441	-0.11337986
C	-0.00567704	0.00163981	-0.01022982	-0.00112425

LOT	XL	XU	YI	AUC	UCP	DIF	PCT	SB	SC
1	0	4	4	1.7500	1.78924	-0.039241	-2.2423	0.92357	0.996073
2	4	38	34	1.3199	1.31801	0.001889	0.1431		
3	38	176	138	1.0761	1.07598	0.000125	0.0116		
4	176	320	144	0.9679	0.96855	-0.000651	-0.0673		
5	320	464	144	0.9184	0.91797	0.000430	0.0468		
6	464	608	144	0.8854	0.88531	0.000092	0.0104		
7	608	724	116	0.8643	0.86439	-0.000095	-0.0110		

LANTIRN (Target Pod)

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	3	64803.78187329	21601.26062443
RESIDUAL	4	0.09890159	0.02472540
UNCORRECTED TOTAL	7	64803.88077488	
(CORRECTED TOTAL)	6	12795.42099227	

LANTIRN (Continued)

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	1.55737445	0.02057367	1.50025354	1.61449535
B	-0.10674327	0.00091327	-0.10927889	-0.10420766
C	-0.00471595	0.00311842	-0.01337396	0.00394206

LOT	XL	XU	YI	AUC	UCP	DIF	PCT	SB	SC
1	0	4	4	1.4375	1.49387	-0.056366	-3.9211	0.928682	0.996736
2	4	38	34	1.1286	1.12579	0.002810	0.2490		
3	38	166	128	0.9375	0.93745	0.000053	0.0057		
4	166	310	144	0.8490	0.84984	-0.000840	-0.0989		
5	310	454	144	0.8081	0.80706	0.001044	0.1292		
6	454	598	144	0.7795	0.77970	-0.000202	-0.0259		
7	598	714	116	0.7619	0.76215	-0.000247	-0.0324		

LANTIRN (Target Recognizer)

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	3	11936.81103964	3978.93701321
RESIDUAL	2	1.58542686	0.79271343
UNCORRECTED TOTAL	5	11938.39646650	
(CORRECTED TOTAL)	4	1483.53065817	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	0.66581050	0.09474413	0.25815492	1.07346609
B	-0.14805250	0.01133024	-0.19680313	-0.09930187
C	0.01528702	0.03329340	-0.12796448	0.15853852

LOT	XL	XU	YI	AUC	UCP	DIF	PCT	SB	SC
1	0	79	79	0.4383	0.437521	0.0007795	0.1778	0.902468	1.01065
2	79	271	192	0.3353	0.339077	-0.0037771	-1.1265		
3	271	463	192	0.2975	0.301586	-0.0040862	-1.3735		
4	463	655	192	0.2865	0.283048	0.0034516	1.2047		
5	655	720	65	0.2693	0.269791	-0.0004906	-0.1822		

ASQ-133

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	3	2906.55856757	968.85285586
RESIDUAL	3	3.01541309	1.00513770
UNCORRECTED TOTAL	6	2909.57398066	
(CORRECTED TOTAL)	5	411.15312705	

ASQ-133 (Continued)

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	0.91551147	0.20351926	0.26781141	1.56321152
B	-0.14707448	0.03204977	-0.24907288	-0.04507607
C	-0.03752060	0.07364414	-0.27189309	0.19685189

LOT	XL	XU	YI	AUC	UCP	DIF	PCT	SB	SC
1	0	14	14	0.5856	0.659452	-0.073852	-12.611	0.90308	0.974328
2	14	33	19	0.5862	0.517781	0.068419	11.672		
3	33	102	69	0.4255	0.423767	0.001733	0.407		
4	102	169	67	0.3828	0.380501	0.002299	0.600		
5	169	250	81	0.3535	0.354104	-0.000604	-0.171		
6	250	308	58	0.3355	0.343515	-0.008015	-2.389		

ASN-108

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	3	559.83537858	186.61179286
RESIDUAL	2	0.79521666	0.39760833
UNCORRECTED TOTAL	5	560.63059524	
(CORRECTED TOTAL)	4	226.66710333	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	0.10713880	0.03609937	-0.04818595	0.26246355
B	-0.02733495	0.05835311	-0.27841087	0.22374097
C	-0.00000000	0.06933503	-0.29832783	0.29832783

LOT	XL	XU	YI	AUC	UCP	DIF	PCT	SB	SC
1	0	8	8	0.1373	0.104063	0.0332367	24.2074	0.981231	1
2	8	39	31	0.1048	0.098515	0.0062847	5.9969		
3	39	116	77	0.0874	0.095246	-0.0078461	-8.9773		
4	116	332	216	0.0943	0.092515	0.0017848	1.8927		
5	332	440	108	0.0872	0.091051	-0.0038505	-4.4158		

ASW-32

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	3	293.17121228	97.72373743
RESIDUAL	3	7.70686140	2.56895380
UNCORRECTED TOTAL	6	300.87807368	
(CORRECTED TOTAL)	5	54.90298664	

ASW-32 (Continued)

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	0.14440912	0.22536620	-0.57281881	0.86163705
B	-0.29806447	0.32910262	-1.34543355	0.74930461
C	0.34351120	0.73482676	-1.99507496	2.68209736

LOT	XL	XU	YI	AUC	UCP	DIF	PCT	SB	SC
1	0	12	12	0.2338	0.230325	0.003475	1.486	0.813343	1.26884
2	12	38	26	0.1643	0.172736	-0.008436	-5.134		
3	38	86	48	0.1524	0.161178	-0.008778	-5.760		
4	86	134	48	0.0974	0.134899	-0.037499	-38.500		
5	134	184	50	0.1441	0.122391	0.021709	15.065		
6	184	264	80	0.1518	0.129929	0.021871	14.408		

JTIDS

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	3	1570.91884746	523.63961582
RESIDUAL	2	0.12319075	0.06159538
UNCORRECTED TOTAL	5	1571.04203821	
(CORRECTED TOTAL)	4	40.25750283	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	1.00784578	0.15366642	0.34666527	1.66902630
B	-0.19033588	0.00837598	-0.22637519	-0.15429656
C	-0.10427120	0.04233875	-0.28644212	0.07789972

LOT	XL	XU	YI	AUC	UCP	DIF	PCT	SB	SC
1	0	45	45	0.4068	0.405547	0.0012531	0.3080	0.876402	0.930275
2	45	121	76	0.2764	0.279071	-0.0026711	-0.9664		
3	121	198	77	0.2466	0.244567	0.0020332	0.8245		
4	198	270	72	0.2308	0.228651	0.0021494	0.9313		
5	270	327	57	0.2205	0.223556	-0.0030559	-1.3859		

D.2.4 - Helicopter Programs

HH-52

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	3	3108.01791013	1036.00597004
RESIDUAL	3	2.94411487	0.98137162
UNCORRECTED TOTAL	6	3110.96202500	
(CORRECTED TOTAL)	5	731.19918350	

HH-52 (Continued)

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	1.71707094	1.90561790	-4.34755804	7.78169993
B	-0.17889259	0.09298328	-0.47481189	0.11702670
C	0.09285582	0.27513150	-0.78275017	0.96846180

LOT	XL	XU	YI	AUC	UCP	DIF	PCT	SB	SC
1	0	28	28	1.577	1.56993	0.007073	0.4485	0.883381	1.06648
2	28	43	15	1.104	1.16778	-0.063784	-5.7775		
3	43	60	17	1.085	1.10467	-0.019670	-1.8129		
4	60	75	15	1.012	1.03977	-0.027766	-2.7436		
5	75	87	12	1.041	0.98552	0.055477	5.3292		
6	87	99	12	1.055	0.96142	0.093580	8.8702		

CH-46

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	3	358394.07558373	119464.69186124
RESIDUAL	5	1218.94357727	243.78871545
UNCORRECTED TOTAL	8	359613.01916100	
(CORRECTED TOTAL)	7	57764.44745087	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	13.88403455	2.82372113	6.62553352	21.14253558
B	-0.11367931	0.03574918	-0.20557417	-0.02178445
C	-0.24879213	0.05354593	-0.38643434	-0.11114992

LOT	XL	XU	YI	AUC	UCP	DIF	PCT	SB	SC
1	0	14	14	7.541	6.01847	1.52253	20.190	0.924228	0.841601
2	14	50	36	3.898	3.86780	0.03020	0.775		
3	50	110	60	2.766	3.05587	-0.28987	-10.480		
4	110	195	85	2.419	2.60033	-0.18133	-7.496		
5	195	394	199	1.986	1.95426	0.03174	1.598		
6	394	486	92	2.236	2.25702	-0.02102	-0.940		
7	486	576	90	2.370	2.22124	0.14876	6.277		
8	576	624	48	2.547	2.56113	-0.01413	-0.555		

H-53

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	3	618901.35194153	206300.45064718
RESIDUAL	5	177.41331847	35.48266369
UNCORRECTED TOTAL	8	619078.76526000	
(CORRECTED TOTAL)	7	355155.11827950	

H-53 (Continued)

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	6.99076933	0.74819532	5.06749992	8.91403874
B	-0.11344858	0.01093379	-0.14155438	-0.08534278
C	-0.00431882	0.01933280	-0.05401464	0.04537701

LOT	XL	XU	YI	AUC	UCP	DIF	PCT	SB	SC
1	0	10	10	6.752	6.01248	0.73952	10.953	0.924376	0.997011
2	10	141	131	4.264	4.28633	-0.02233	-0.524		
3	141	281	140	3.762	3.73778	0.02422	0.644		
4	281	293	12	3.382	3.63936	-0.25736	-7.610		
5	293	323	30	3.341	3.59621	-0.25521	-7.639		
6	323	331	8	3.154	3.59215	-0.43815	-13.892		
7	331	361	30	3.685	3.54902	0.13598	3.690		
8	361	367	6	3.947	3.55313	0.39387	9.979		

CH-47

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	3	480706.48095732	160235.49365244
RESIDUAL	9	5154.05403268	572.67267030
UNCORRECTED TOTAL	12	485860.53499000	
(CORRECTED TOTAL)	11	132801.70813367	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	13.07942819	3.51723957	5.12281180	21.03604458
B	-0.07964745	0.04681193	-0.18554428	0.02624939
C	-0.24388675	0.06553656	-0.39214200	-0.09563149

LOT	XL	XU	YI	AUC	UCP	DIF	PCT	SB	SC
1	0	18	18	6.181	5.57842	0.60258	9.749	0.946289	0.844467
2	18	42	24	5.226	4.60654	0.61946	11.853		
3	42	66	24	4.559	4.38839	0.17061	3.742		
4	66	126	60	3.459	3.35479	0.10421	3.013		
5	126	198	72	2.760	3.07567	-0.31567	-11.437		
6	198	358	160	2.307	2.42605	-0.11905	-5.161		
7	358	442	84	2.313	2.75489	-0.44189	-19.105		
8	442	585	143	2.695	2.37227	0.32273	11.975		
9	585	630	45	3.463	3.10240	0.36060	10.413		
10	630	666	36	3.085	3.25910	-0.17410	-5.643		
11	666	678	12	3.671	4.24814	-0.57714	-15.722		
12	678	690	12	3.852	4.24215	-0.39015	-10.129		

H-54

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	3	21003.31608907	7001.10536302
RESIDUAL	2	125.47281893	62.73640947
UNCORRECTED TOTAL	5	21128.78890800	
(CORRECTED TOTAL)	4	3891.65021280	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	3.72554423	3.40014141	-6.90424420	22.35533265
B	-0.06524072	0.07399436	-0.38361625	0.25313481
C	-0.20591907	0.15528908	-0.87408140	0.46224325

LOT	XL	XU	YI	AUC	UCP	DIF	PCT	SB	SC
1	0	6	6	5.248	5.08424	0.16376	3.120	0.955786	0.866986
2	6	30	24	3.388	3.34549	0.04251	1.255		
3	30	60	30	2.801	2.99560	-0.19460	-6.948		
4	60	83	23	3.402	3.06675	0.33525	9.855		
5	83	89	6	3.083	3.99476	-0.91176	-29.574		

HH-60D

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	3	123890.14662502	41296.71554167
RESIDUAL	1	2.07337498	2.07337498
UNCORRECTED TOTAL	4	123892.22000000	
(CORRECTED TOTAL)	3	24351.97000000	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	9.56059757	0.6359062[illegible]	1.48077339	17.64042174
B	-0.03712973	0.00728771	-0.12972743	0.05546797
C	-0.06138061	0.02339785	-0.35867364	0.23591242

LOT	XL	XU	YI	AUC	UCP	DIF	PCT	SB	SC
1	0	3	3	9.2	8.91078	0.289217	3.14367	.974592	0.958347
2	3	28	25	7.1	7.12604	-0.026042	-0.36679		
3	28	63	35	6.7	6.67698	0.023019	0.34357		
4	63	92	29	6.6	6.61716	-0.017158	-0.25998		

SH-3

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	3	72686.31828727	24228.77276242
RESIDUAL	6	289.99525473	48.33254245
UNCORRECTED TOTAL	9	72976.31354200	
(CORRECTED TOTAL)	8	13013.69066156	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	3.13675058	0.91598293	0.89541946	5.37808169
B	-0.17697129	0.02818133	-0.24592856	-0.10801401
C	0.11598623	0.07512575	-0.06783998	0.29981245

LOT	XL	XU	YI	AUC	UCP	DIF	PCT	SB	SC
1	0	20	20	3.327	3.17484	0.15216	4.574	0.884558	1.08372
2	20	69	49	2.480	2.54635	-0.06635	-2.675		
3	69	140	71	2.319	2.26822	0.05078	2.190		
4	140	185	45	1.811	1.98273	-0.17173	-9.483		
5	185	221	36	1.870	1.85673	0.01327	0.710		
6	221	257	36	1.589	1.80371	-0.21471	-13.512		
7	257	287	30	1.703	1.72585	-0.02285	-1.342		
8	287	335	48	1.930	1.78002	0.14998	7.771		
9	335	350	15	2.144	1.52875	0.61525	28.697		

D.2.5 - Tactical Armaments Programs

LLLGB

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	3	220658971276.28237	73552990425.42745
RESIDUAL	7	7446216.71754	1063745.24536
UNCORRECTED TOTAL	10	220666417492.99991	
(CORRECTED TOTAL)	9	31936246324.90007	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	83.51938087	5.61998616	70.23011861	96.80864312
B	-0.16849992	0.00538892	-0.18124279	-0.15575706
C	-0.00533737	0.01179681	-0.03323262	0.02255788

LLLGB (continued)

LOT	XL	XU	YI	AUC	UCP	DIF	PCT	SB	SC
1	0	1600	1600	27.5	27.8567	-0.35669	-1.2970	0.889767	0.996307
2	1600	4550	2950	20.6	20.8509	-0.25092	-1.2181		
3	4550	8290	3740	18.9	18.2975	0.60247	3.1877		
4	8290	17270	8980	16.2	16.2395	-0.03947	-0.2437		
5	17270	26890	9620	14.7	14.7656	-0.06560	-0.4463		
6	26890	41290	14400	13.7	13.6927	0.00726	0.0530		
7	41290	56890	15600	12.9	12.8629	0.03713	0.2878		
8	56890	72490	15600	12.3	12.2741	0.02590	0.2106		
9	72490	88090	15600	11.8	11.8333	-0.03333	-0.2824		
10	88090	100000	11910	11.5	11.5367	-0.03674	-0.3195		

CEM

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	3	1106465407508.7963	368821802502.9321
RESIDUAL	5	647791385.9557	129558277.1911
UNCORRECTED TOTAL	8	1107113198894.7521	
(CORRECTED TOTAL)	7	367517125638.9579	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	64.88484215	23.60380663	4.21020501	125.55947929
B	-0.21306904	0.03316583	-0.29832330	-0.12781479
C	0.07874304	0.06323790	-0.08381279	0.24129887

LOT	XL	XU	YI	AUC	UCP	DIF	PCT	SB	SC
1	0	172	172	69.24	41.2969	27.9431	40.357	0.8627	1.0561
2	172	1432	1260	30.38	28.3581	2.0219	6.655		
3	1432	7557	6125	19.88	22.0074	-2.1274	-10.701		
4	7557	21777	14220	17.65	18.0396	-0.3896	-2.207		
5	21777	50227	28450	16.19	15.6728	0.5172	3.195		
6	50227	85247	35020	14.01	13.8662	0.1438	1.027		
7	85247	134157	48910	12.58	12.8361	-0.2561	-2.036		
8	134157	171666	37509	11.81	11.6940	0.1160	0.982		

GBU-15

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	3	39932243362.858823	13310747787.619607
RESIDUAL	6	148042874.141165	24673812.356861
UNCORRECTED TOTAL	9	40080286236.999989	
(CORRECTED TOTAL)	8	10225399631.555555	

GBU-15 (Continued)

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	44.29128355	32.06024664	-34.15737052	122.73993762
B	-0.11323394	0.05993191	-0.25988216	0.03341427
C	0.32918934	0.16292539	-0.06947501	0.72785369

LOT	XL	XU	YI	AUC	UCP	DIF	PCT	SB	SC
1	0	40	40	197.5	110.785	86.715	43.906	0.924513	1.25631
2	40	105	65	200.0	108.248	91.752	45.876		
3	105	445	340	143.9	161.234	-17.334	-12.046		
4	445	695	250	148.3	133.070	15.230	10.269		
5	695	1015	320	130.8	137.820	-7.020	-5.367		
6	1015	1615	600	171.8	161.499	10.301	5.996		
7	1615	2215	600	153.9	154.678	-0.778	-0.506		
8	2215	2815	600	148.3	149.944	-1.644	-1.109		
9	2815	3415	600	142.0	146.340	-4.340	-3.056		

D.2.6 - Tactical Missile Programs

AMRAAM

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	3	3264262.44261975	1088087.48087325
RESIDUAL	7	1658.08623325	236.86946189
UNCORRECTED TOTAL	10	3265920.52885300	
(CORRECTED TOTAL)	9	185036.68624890	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	5.14774640	1.14741785	2.43451253	7.86098026
B	-0.33199274	0.01695159	-0.37207719	-0.29190828
C	-0.02275196	0.04457006	-0.12814424	0.08264032

LOT	XL	XU	YI	AUC	UCP	DIF	PCT	SB	SC
1	0	194	194	1.223	1.18919	0.0338130	2.7648	0.794438	0.984353
2	194	1251	1057	0.512	0.51937	-0.0073667	-1.4388		
3	1251	3215	1964	0.342	0.34005	0.0019478	0.5695		
4	3215	6211	2996	0.257	0.26084	-0.0038351	-1.4923		
5	6211	9111	2900	0.232	0.22103	0.0109718	4.7292		
6	9111	12011	2900	0.194	0.19843	-0.0044300	-2.2835		
7	12011	14911	2900	0.182	0.18297	-0.0009743	-0.5353		
8	14911	17911	3000	0.170	0.17115	-0.0011511	-0.6771		
9	17911	20911	3000	0.158	0.16184	-0.0038440	-2.4329		
10	20911	24674	3763	0.155	0.15266	0.0023383	1.5086		

HARM

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	3	1581036.30447836	527012.10149279
RESIDUAL	8	399.00661464	49.87582683
UNCORRECTED TOTAL	11	1581435.31109300	
(CORRECTED TOTAL)	10	341122.41543764	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	2.05975337	0.20579162	1.58519245	2.53431428
B	-0.17087678	0.01069974	-0.19555065	-0.14620291
C	-0.10303830	0.02041551	-0.15011700	-0.05595960

LOT	XL	XU	YI	AUC	UCP	DIF	PCT	SB	SC
1	0	80	80	0.809	0.748016	0.0609837	7.5382	0.888303	0.93107
2	80	316	236	0.517	0.481668	0.0353319	6.8340		
3	316	712	396	0.400	0.384746	0.0152536	3.8134		
4	712	1399	687	0.314	0.320960	-0.0069602	-2.2166		
5	1399	3144	1745	0.249	0.256164	-0.0071643	-2.8772		
6	3144	5612	2468	0.223	0.220417	0.0025825	1.1581		
7	5612	7731	2119	0.208	0.207967	0.0000334	0.0160		
8	7731	9863	2132	0.197	0.198171	-0.0011715	-0.5947		
9	9863	12863	3000	0.184	0.183148	0.0008517	0.4629		
10	12863	15863	3000	0.177	0.175922	0.0010779	0.6090		
11	15863	16961	1098	0.186	0.190660	-0.0046601	-2.5054		

IIR-MAVERICK

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	3	2028079.43212684	676026.47737561
RESIDUAL	6	3384.67318216	564.11219703
UNCORRECTED TOTAL	9	2031464.10530900	
(CORRECTED TOTAL)	8	458719.86902800	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	0.80241576	0.31536706	0.03073981	1.57409171
B	-0.11839215	0.03230768	-0.19744626	-0.03933804
C	-0.15377186	0.06466296	-0.31199653	0.00445282

IIR-MAVERICK (Continued)

LOT	XL	XU	YI	AUC	UCP	DIF	PCT	SB	SC
1	0	200	200	0.309	0.215212	0.093788	30.352	0.921214	0.898897
2	200	1100	900	0.135	0.132626	0.002374	1.758		
3	1100	3700	2600	0.083	0.095985	-0.012985	-15.645		
4	3700	9429	5729	0.082	0.075255	0.006745	8.226		
5	9429	18429	9000	0.062	0.064088	-0.002088	-3.368		
6	18429	30429	12000	0.057	0.057310	-0.000310	-0.544		
7	30429	42429	12000	0.055	0.054621	0.000379	0.689		
8	42429	54429	12000	0.053	0.052796	0.000204	0.384		
9	54429	60664	6235	0.057	0.057193	-0.000193	-0.338		

AIM-7FR

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	3	114901.98806123	38300.66268708
RESIDUAL	5	249.59683877	49.91936775
UNCORRECTED TOTAL	8	115151.58490000	
(CORRECTED TOTAL)	7	6543.29278750	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	4.37215318	1.54136486	0.41000611	8.33430026
B	-0.29632554	0.04997786	-0.42479586	-0.16785522
C	-0.17260944	0.10111182	-0.43252187	0.08730299

LOT	XL	XU	YI	AUC	UCP	DIF	PCT	SB	SC
1	0	100	100	0.741	0.716891	0.024109	3.2535	0.814324	0.887236
2	100	325	225	0.378	0.357863	0.020137	5.3274		
3	325	925	600	0.199	0.218605	-0.019605	-9.8517		
4	925	1725	800	0.169	0.164824	0.004176	2.4710		
5	1725	2825	1100	0.134	0.132624	0.001376	1.0269		
6	2825	4225	1400	0.116	0.111594	0.004406	3.7980		
7	4225	5125	900	0.111	0.110554	0.000446	0.4020		
8	5125	6269	1144	0.095	0.100039	-0.005039	-5.3043		

AIM-7FGD

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	3	28536.34707812	9512.11569271
RESIDUAL	3	84.81094688	28.27031563
UNCORRECTED TOTAL	6	28621.15802500	
(CORRECTED TOTAL)	5	7732.20792083	

AIM-7FGD (Continued)

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	2.40515542	0.82076718	-0.20693614	5.01724698
B	-0.36879907	0.15873416	-0.87397053	0.13637240
C	-0.06982538	0.20279429	-0.71521820	0.57556743

LOT	XL	XU	YI	AUC	UCP	DIF	PCT	SB	SC
1	0	15	15	1.551	1.16174	0.389257	25.097	0.774427	0.952753
2	15	85	70	0.379	0.44462	-0.065621	-17.314		
3	85	295	210	0.228	0.24616	-0.018159	-7.965		
4	295	505	210	0.195	0.18278	0.012216	6.265		
5	505	1255	750	0.130	0.12635	0.003648	2.806		
6	1255	2565	1310	0.090	0.09077	-0.000767	-0.852		

D.3 - TASC RUNS

This section contains the results of The Analytic Sciences Corporation's computer runs. These results were extracted from the AFSC Production Rate Model data handbook (18).

D.3.1 - Bomber Aircraft Prorgams

B-1B

LOT	QUANTITY	RECURRING AVERAGE UNIT COST ACTUAL	PREDICTED	PERCENTAGE DIFFERENCE	PARAMETERS
1	1	535.8	--	--	A = 450.61
2	7	260.3	267.4	-2.76	SLOPE
3	10	200.5	196.4	2.04	B = .83
4	34	142.0	141.0	0.69	C = .95
5	48	111.3	111.9	-0.51	

B-52

LOT	QUANTITY	RECURRING AVERAGE UNIT COST ACTUAL	PREDICTED	PERCENTAGE DIFFERENCE	PARAMETERS
1	20	112.5	--	--	A = 74.4
2	43	37.0	38.9	-5.10	SLOPE
3	25	28.6	33.1	-15.84	B = .90
4	77	32.3	28.1	12.95	C = .96
5	133	23.4	24.5	-4.62	
6	202	28.4	28.4	0.00	
7	101	27.3	27.1	0.75	
8	39	27.3	28.3	-3.56	
9	62	35.4	--	--	
10	40	35.0	--	--	

B-58

LOT	QUANTITY	RECURRING AVERAGE UNIT COST ACTUAL	PREDICTED	PERCENTAGE DIFFERENCE	PARAMETERS
1	17	93.86	93.86	0.00	A = 106.25
2	36	80.26	80.26	0.00	SLOPE
3	20	73.16	73.16	0.00	B = .93
4	30	36.56	--	--	C = 1.00

D.3.2 - Fighter Aircraft Programs

A-10

LOT	QUANTITY	RECURRING AVERAGE UNIT COST ACTUAL	PREDICTED	PERCENTAGE DIFFERENCE	PARAMETERS
1	22	12.37	--	--	A = 17.19
2	53	9.16	9.11	0.6	SLOPE
3	20	8.20	8.52	-3.9	B = .99
4	100	8.20	8.22	-0.3	C = .89
5	144	7.82	7.75	0.9	
6	144	7.59	7.74	-2.0	
7	144	7.82	7.73	1.1	
8	60	10.18	10.35	-1.7	
9	20	13.64	12.31	9.8	

F-100

LOT	QUANTITY	RECURRING AVERAGE UNIT COST ACTUAL	PREDICTED	PERCENTAGE DIFFERENCE	PARAMETERS
1	23	6.51	5.92	9.11	A = 8.86
2	545	3.45	3.51	-1.71	SLOPE
3	593	3.08	3.03	1.86	B = .93
4	559	3.10	2.86	7.81	C = .97
5	557	2.50	2.75	-10.17	

F-101

LOT	QUANTITY	RECURRING AVERAGE UNIT COST ACTUAL	PREDICTED	PERCENTAGE DIFFERENCE	PARAMETERS
1	31	16.85	--	--	A = 7.06
2	84	7.58	7.65	-0.98	SLOPE
3	309	6.91	6.88	0.42	B = .92
4	206	5.76	5.87	-1.99	C = 1.00
5	84	5.27	5.09	3.46	
6	93	5.22	5.06	3.02	

F-102

LOT	QUANTITY	RECURRING AVERAGE UNIT COST ACTUAL	PREDICTED	PERCENTAGE DIFFERENCE	PARAMETERS
1	37	11.66	11.11	4.74	A = 20.42
2	108	5.17	5.45	-5.45	SLOPE
3	562	3.50	3.50	0.00	B = .74
4	140	2.21	2.09	5.28	C = 1.00

F-106

LOT	QUANTITY	RECURRING AVERAGE UNIT COST ACTUAL	PREDICTED	PERCENTAGE DIFFERENCE	PARAMETERS
1	42	34.19	--	--	A = 50.73
2	88	10.54	10.54	0.00	SLOPE
3	45	11.64	11.64	0.00	B = .95
4	165	7.59	7.59	0.00	C = .82

F-15A/B

LOT	QUANTITY	RECURRING AVERAGE UNIT COST ACTUAL	PREDICTED	PERCENTAGE DIFFERENCE	PARAMETERS
1	30	25.597	23.998	6.25	A = 26.36
2	62	19.556	19.911	-1.82	SLOPE
3	72	17.183	17.949	-4.45	B = .90
4	108	17.126	17.112	0.08	C = 1.00
5	24	16.021	16.271	-1.56	
6	108	16.272	15.930	2.10	

F-15C/D

LOT	QUANTITY	RECURRING AVERAGE UNIT COST ACTUAL	PREDICTED	PERCENTAGE DIFFERENCE	PARAMETERS
1	97	17.249	16.829	2.43	A = 163.93
2	78	15.588	16.111	-3.35	SLOPE
3	60	15.508	17.237	-11.15	B = .93
4	42	17.665	19.569	-10.78	C = .75
5	36	19.943	10.578	-3.19	
6	39	19.308	19.661	-1.83	
7	36	21.954	20.114	8.38	
8	48	21.017	17.638	16.08	

F-15E

LOT	QUANTITY	RECURRING AVERAGE UNIT COST ACTUAL	PREDICTED	PERCENTAGE DIFFERENCE	PARAMETERS
1	60	20.544	21.096	-2.69	A = 34.86
2	72	19.203	18.488	3.72	SLOPE
3	96	17.608	17.224	2.18	B = .94
4	96	16.175	16.604	-2.65	C = .96
5	96	16.041	16.188	-0.91	
6	96	17.927	--	--	

F-16A/B

LOT	QUANTITY	RECURRING AVERAGE UNIT COST ACTUAL	PREDICTED	PERCENTAGE DIFFERENCE	PARAMETERS
1	105	10.14	10.14	0.00	A = 19.34
2	145	7.74	7.74	0.00	SLOPE
3	175	8.04	8.04	0.00	B = .99
4	180	5.05	5.05	0.00	C = .99
5	120	5.13	5.13	0.00	

F-16E

LOT	QUANTITY	RECURRING AVERAGE UNIT COST ACTUAL	PREDICTED	PERCENTAGE DIFFERENCE	PARAMETERS
1	120	9.86	8.95	9.27	A =885.98
2	144	10.58	12.06	-13.95	SLOPE
3	150	14.55	13.75	5.53	B = .95
4	216	11.93	11.93	0.00	C = .61
5	216	11.28	11.26	0.19	
6	216	11.02	11.04	-0.19	
7	216	10.88	10.87	0.07	
8	216	10.69	10.73	-0.31	
9	216	10.61	10.61	-0.38	
10	216	10.54	10.51	0.28	

D.3.3 - Electronics Programs

ARC-109V

LOT	QUANTITY	RECURRING AVERAGE UNIT COST ACTUAL	PREDICTED	PERCENTAGE DIFFERENCE	PARAMETERS
1	4	.0487	--	--	A = .02776
2	24	.0393	.0297	24.33	SLOPE
3	79	.0285	.0305	-7.01	B = .99
4	226	.0313	.0312	0.35	C = 1.00
5	108	.0303	.0307	0.40	

ARC-54

LOT	QUANTITY	RECURRING AVERAGE UNIT COST ACTUAL	PREDICTED	PERCENTAGE DIFFERENCE	PARAMETERS
1	900	.0210	--	--	A = .02986
2	853	.0165	.0168	-2.02	SLOPE
3	1381	.0164	.0155	5.68	B = .97
4	1160	.0145	.0152	-5.15	C = .97
5	300	.0144	.0162	-12.73	
6	3103	.0139	.0141	-1.74	
7	2650	.0143	.0140	1.95	

ASN-63

LOT	QUANTITY	RECURRING AVERAGE UNIT COST ACTUAL	PREDICTED	PERCENTAGE DIFFERENCE	PARAMETERS
1	781	.1866	.1862	0.23	A = .24478
2	149	.1744	.1880	-7.82	SLOPE
3	287	.1769	.1845	-4.27	B = .89
4	141	.1817	.1865	-2.63	C = .99
5	92	.1772	.1878	-5.99	
6	135	.2189	.1859	15.06	
7	108	.1911	.1865	2.41	
8	158	.1917	.1846	3.68	
9	36	.2005	.1903	5.06	
10	36	.2145	--	--	

ASN-70

LOT	QUANTITY	RECURRING AVERAGE UNIT COST ACTUAL	PREDICTED	PERCENTAGE DIFFERENCE	PARAMETERS
1	152	.0350	.0350	0.00	A = .03387
2	250	.0353	.0353	0.00	SLOPE
3	81	.0342	.0351	-2.73	B = 1.00
4	58	.0356	.0351	1.41	C = 1.00
5	26	.0370	.0350	5.44	
6	8	.0399	.0348	12.75	
7	11	.0427	--	--	

ASN-99

LOT	QUANTITY	RECURRING AVERAGE UNIT COST ACTUAL	PREDICTED	PERCENTAGE DIFFERENCE	PARAMETERS
1	157	.0464	.0440	5.07	A = .1466
2	196	.0404	.0429	-6.24	SLOPE
3	185	.0413	.0441	-6.77	B = 1.00
4	243	.0433	.0415	4.20	C = .84
5	24	.0570	.0752	-31.91	
6	72	.0624	.0568	8.85	
7	56	.0635	.0607	4.35	
8	117	.0684	--	--	

CP-1035N

LOT	QUANTITY	RECURRING AVERAGE UNIT COST ACTUAL	PREDICTED	PERCENTAGE DIFFERENCE	PARAMETERS
1	12	.1248	.1187	4.91	A = .1886
2	26	.0903	.1185	-31.18	SLOPE
3	48	.1236	.1136	8.08	B = 1.00
4	48	.1287	.1238	3.83	C = .82
5	50	.1310	.1290	1.41	
6	80	.1154	.1187	-2.82	

LANTIRN (Navigation Pod)

LOT	QUANTITY	RECURRING AVERAGE UNIT COST ACTUAL	PREDICTED	PERCENTAGE DIFFERENCE	PARAMETERS
1	4	1.7500	1.7248	1.44	A = 1.9056
2	34	1.3199	1.3205	-0.04	SLOPE
3	138	1.0761	1.0761	0.00	B = .92
4	144	.9679	.9688	-0.06	C = .99
5	144	.9184	.9179	0.06	
6	144	.8854	.8851	0.03	
7	116	.8643	.8648	-0.06	

LANTIRN (Target Pod)

LOT	QUANTITY	RECURRING AVERAGE UNIT COST ACTUAL	PREDICTED	PERCENTAGE DIFFERENCE	PARAMETERS
1	4	1.4375	1.4345	0.21	A = 1.5639
2	34	1.1286	1.1284	0.02	SLOPE
3	128	.9375	.9376	-0.01	B = .93
4	144	.8490	.8491	-0.03	C = 1.00
5	144	.8081	.8073	0.12	
6	144	.7795	.7799	-0.06	
7	116	.7619	.7621	-0.03	

LANTIRN (Target Recognizer)

LOT	QUANTITY	RECURRING AVERAGE UNIT COST ACTUAL	PREDICTED	PERCENTAGE DIFFERENCE	PARAMETERS
1	79	.4383	.4381	0.03	A = .7244
2	192	.3353	.3354	-0.03	SLOPE
3	192	.2975	.2974	0.04	B = .90
4	192	.2865	.2865	0.00	C = 1.00
5	65	.2693	.2695	-0.08	

ASQ-133

LOT	QUANTITY	RECURRING AVERAGE UNIT COST ACTUAL	PREDICTED	PERCENTAGE DIFFERENCE	PARAMETERS
1	14	.5856	--	--	A = .8475
2	19	.5862	.5806	0.96	SLOPE
3	68	.4255	.4288	-0.77	B = .91
4	67	.3828	.3787	1.07	C = .98
5	81	.3535	.3517	0.50	
6	58	.3355	.3404	-1.47	

ASN-108

LOT	QUANTITY	RECURRING AVERAGE UNIT COST ACTUAL	PREDICTED	PERCENTAGE DIFFERENCE	PARAMETERS
1	8	.1373	.1299	5.39	A = .19531
2	31	.1048	.1028	1.88	SLOPE
3	77	.0874	.0879	-0.65	B = 1.00
4	216	.0943	.0944	-0.15	C = .86
5	108	.0872	.0866	0.74	

ASW-32

LOT	QUANTITY	RECURRING AVERAGE UNIT COST ACTUAL	PREDICTED	PERCENTAGE DIFFERENCE	PARAMETERS
1	12	.2338	.2284	2.33	A = .4552
2	26	.1643	.1698	-3.35	SLOPE
3	48	.1524	.1375	9.75	B = .95
4	48	.0974	.1313	-34.84	C = .86
5	50	.1441	.1264	12.29	
6	80	.1518	.1514	0.29	

JTIDS

LOT	QUANTITY	RECURRING AVERAGE UNIT COST ACTUAL	PREDICTED	PERCENTAGE DIFFERENCE	PARAMETERS
1	45	.4068	.4054	0.36	A = 1.1038
2	76	.2764	.2793	-1.08	SLOPE
3	77	.2466	.2444	0.94	B = .87
4	72	.2308	.2346	1.04	C = .92
5	57	.2205	.2240	-1.58	

D.3.4 - Helicopter Programs

HH-52

LOT	QUANTITY	RECURRING AVERAGE UNIT COST ACTUAL	PREDICTED	PERCENTAGE DIFFERENCE	PARAMETERS
1	28	1.577	---	---	A = 1.170
2	15	1.104	1.107	-0.31	SLOPE
3	17	1.085	1.065	1.82	B = .98
4	15	1.012	1.049	-3.63	C = .99
5	12	1.041	1.040	0.13	
6	12	1.055	1.033	2.05	

CH-46

LOT	QUANTITY	RECURRING AVERAGE UNIT COST ACTUAL	PREDICTED	PERCENTAGE DIFFERENCE	PARAMETERS
1	14	7.541	---	---	A = 9.835
2	36	3.898	3.621	7.12	SLOPE
3	60	2.766	2.883	-4.24	B = .96
4	85	2.419	2.521	-4.21	C = .86
5	199	1.986	1.978	0.41	
6	92	2.236	2.277	-1.84	
7	90	2.370	2.256	4.82	
8	48	2.547	2.574	-1.06	

H-53

LOT	QUANTITY	RECURRING AVERAGE UNIT COST ACTUAL	RECURRING AVERAGE UNIT COST PREDICTED	PERCENTAGE DIFFERENCE	PARAMETERS
1	10	6.752	---	---	A = 4.817
2	131	4.264	4.264	0.00	SLOPE
3	140	3.762	3.762	0.00	B = .94
4	12	3.382	3.254	3.80	C = 1.00
5	30	3.341	3.373	0.94	
6	8	3.154	3.154	0.00	
7	30	3.685	---	---	
8	6	3.947	---	---	

CH-47

LOT	QUANTITY	RECURRING AVERAGE UNIT COST ACTUAL	RECURRING AVERAGE UNIT COST PREDICTED	PERCENTAGE DIFFERENCE	PARAMETERS
1	18	6.181	---	---	A = 11.029
2	24	5.226	4.602	11.93	SLOPE
3	24	4.559	4.249	6.81	B = .96
4	60	3.459	3.281	5.16	C = .85
5	72	2.760	3.028	-9.69	
6	160	2.307	2.429	-5.27	
7	84	2.313	2.753	-19.00	
8	143	2.695	2.395	11.13	
9	45	3.463	3.098	10.54	
10	36	3.085	3.249	-5.33	
11	12	3.671	4.183	-13.97	
12	12	3.852	4.179	-8.50	

H-54

LOT	QUANTITY	RECURRING AVERAGE UNIT COST ACTUAL	RECURRING AVERAGE UNIT COST PREDICTED	PERCENTAGE DIFFERENCE	PARAMETERS
1	6	5.248	5.608	-6.86	A = 11.482
2	24	3.388	3.228	4.74	SLOPE
3	30	2.801	2.957	-5.57	B = 1.00
4	23	3.402	3.293	3.20	C = .76
5	6	3.083	---	---	

HH-60D

LOT	QUANTITY	RECURRING AVERAGE UNIT COST ACTUAL	RECURRING AVERAGE UNIT COST PREDICTED	PERCENTAGE DIFFERENCE	PARAMETERS
1	3	9.2	8.5	7.61	A = 9.0
2	25	7.1	7.1	0.00	SLOPE
3	35	6.7	6.7	0.00	B = .97
4	29	6.6	6.6	0.00	C = .97

SH-3

LOT	QUANTITY	RECURRING AVERAGE UNIT COST ACTUAL	PREDICTED	PERCENTAGE DIFFERENCE	PARAMETERS
1	20	3.327	3.267	1.81	A = 4.074
2	49	2.480	2.543	-2.52	SLOPE
3	71	2.319	2.219	4.34	B = .89
4	45	1.811	2.009	-10.92	C = 1.00
5	36	1.870	1.914	-2.34	
6	36	1.589	1.861	-17.11	
7	30	1.703	1.805	-5.99	
8	48	1.930	1.747	9.49	
9	15	2.144	1.683	21.53	

D.3.5 - Tactical Armaments Programs

LLLGB

LOT	QUANTITY	RECURRING AVERAGE UNIT COST ACTUAL	PREDICTED	PERCENTAGE DIFFERENCE	PARAMETERS
1	1600	.0275	.0278	-1.23	A = .0836
2	2950	.0206	.0209	-1.23	SLOPE
3	3740	.0189	.0183	3.17	B = .89
4	8980	.0162	.0162	-0.25	C = .99
5	9620	.0147	.0148	-0.45	
6	14400	.0137	.0137	0.00	
7	15600	.0129	.0129	0.00	
8	15600	.0123	.0123	0.00	
9	15600	.0118	.0118	0.00	
10	11910	.0115	.0115	0.00	

CEM

LOT	QUANTITY	RECURRING AVERAGE UNIT COST ACTUAL	PREDICTED	PERCENTAGE DIFFERENCE	PARAMETERS
1	172	.06924	---	---	A = .06023
2	1260	.03038	.03082	-1.46	SLOPE
3	6125	.01988	.02197	10.57	B = .86
4	14220	.01765	.01797	-1.79	C = 1.00
5	28450	.01619	.01566	3.30	
6	35020	.01401	.01386	1.07	
7	48910	.01258	.01286	-2.20	
8	37509	.01181	.01685	1.06	

GBU-15

LOT	QUANTITY	RECURRING AVERAGE UNIT COST ACTUAL	PREDICTED	PERCENTAGE DIFFERENCE	PARAMETERS
1	40	.1975	---	---	A = .46941
2	65	.2000	.2086	-4.29	SLOPE
3	340	.1439	.1438	0.16	B = .96
4	250	.1483	.1427	3.76	C = .90
5	320	.1308	.1341	-2.56	
6	600	.1718	.1704	0.80	
7	600	.1539	.1568	-1.88	
8	600	.1483	.1477	0.38	
9	600	.1420	.1410	0.68	

D.3.6 - Tactical Missile Programs

AMRAAM

LOT	QUANTITY	RECURRING AVERAGE UNIT COST ACTUAL	PREDICTED	PERCENTAGE DIFFERENCE	PARAMETERS
1	194	1.223	1.190	2.65	A = 5.57
2	1057	.512	.520	-1.78	SLOPE
3	1964	.342	.340	0.63	B = .80
4	2996	.257	.260	1.13	C = .97
5	2900	.232	.220	4.86	
6	2900	.194	.198	-2.46	
7	2900	.182	.183	-0.63	
8	3000	.170	.172	-0.60	
9	3000	.158	.161	-2.20	
10	3763	.155	.150	0.97	

HARM

LOT	QUANTITY	RECURRING AVERAGE UNIT COST ACTUAL	PREDICTED	PERCENTAGE DIFFERENCE	PARAMETERS
1	80	.809	---	---	A = 2.019
2	236	.517	.478	7.74	SLOPE
3	396	.400	.383	4.36	B = .89
4	687	.314	.320	-1.76	C = .94
5	1745	.249	.256	-2.81	
6	2468	.223	.220	1.22	
7	2119	.208	.208	0.00	
8	2132	.197	.198	-0.46	
9	3000	.184	.183	0.52	
10	3000	.177	.176	0.30	
11	1098	.186	.190	-2.21	

IIR MAVERICK

LOT	QUANTITY	RECURRING AVERAGE UNIT COST ACTUAL	PREDICTED	PERCENTAGE DIFFERENCE	PARAMETERS
1	200	.309	.211	31.04	A = .789
2	900	.135	.132	2.41	SLOPE
3	2600	.083	.096	-15.74	B = .92
4	5729	.082	.075	7.74	C = .90
5	9000	.062	.064	-2.82	
6	12000	.057	.057	0.00	
7	12000	.055	.055	0.00	
8	12000	.053	.053	0.00	
9	6235	.057	.057	0.00	

AIM-7FR

LOT	QUANTITY	RECURRING AVERAGE UNIT COST ACTUAL	PREDICTED	PERCENTAGE DIFFERENCE	PARAMETERS
1	100	.741	.708	4.50	A = 4.21
2	225	.378	.360	4.80	SLOPE
3	600	.199	.222	-11.30	B = .81
4	800	.169	.163	3.50	C = .84
5	1100	.134	.132	.80	
6	1400	.116	.112	3.40	
7	900	.111	.110	0.30	
8	1144	.095	.100	-5.00	

AIM-7FGD

LOT	QUANTITY	RECURRING AVERAGE UNIT COST ACTUAL	PREDICTED	PERCENTAGE DIFFERENCE	PARAMETERS
1	15	1.551	---	---	A = 2.26
2	70	.379	.421	-11.02	SLOPE
3	210	.228	.228	0.00	B = .89
4	210	.195	.197	-0.84	C = .83
5	750	.130	.123	5.69	
6	1310	.090	.092	-2.87	

D.4 - Alternative 1 SAS Results

This section presents the results of the SAS computer runs for alternative production rate formulation number one.

D.4.1 - Bomber Aircraft Programs

B-1B

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS SOURCE	DF	SUM OF SQUARES	DEPENDENT VARIABLE TCA MEAN SQUARE
REGRESSION	4	59467624.76159497	14866906.19042374
RESIDUAL	1	10352.04830502	10352.04830502
UNCORRECTED TOTAL	5	59477976.80999999	
(CORRECTED TOTAL)	4	17234615.03200000	

B-1B (Continued)

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	432.60609953	47.39995173	-169.65768710	1034.86988615
B	-0.18060857	0.17418799	-2.39384118	2.03262405
C	-0.15076232	0.21418053	-2.87214017	2.57061553
D	0.03327202	0.07931877	-0.97455228	1.04109637

LOT	XL	XU	YI	VI	AUC	UCP	DIF	PCT
1	0	1	1	1.00000	535.8	527.959	7.8407	1.4634
2	1	8	7	7.00000	260.3	269.750	-9.4505	-3.6306
3	8	18	10	1.42857	200.5	195.749	4.7508	2.3695
4	18	52	34	3.40000	142.0	140.598	1.4023	0.9875
5	52	100	48	1.41176	111.3	112.075	-0.7751	-0.6964

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	70075277.99767277	17518819.49941819
RESIDUAL	6	2325493.91232720	387582.31872120
UNCORRECTED TOTAL	10	72400771.90999997	
(CORRECTED TOTAL)	9	18070289.98900000	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	139.96587896	79.65725031	-54.94853154	334.88028947
B	-0.20671296	0.12459875	-0.51159533	0.09816940
C	-0.07641438	0.18858489	-0.53786530	0.38503655
D	-0.11616895	0.18432961	-0.56720758	0.33486967

LOT	XL	XU	YI	VI	AUC	UCP	DIF	PCT
1	0	20	20	1.00000	112.5	75.5500	36.950	32.844
2	20	63	43	2.15000	37.0	45.0258	-8.026	-21.691
3	63	88	25	0.58140	28.6	47.7380	-19.138	-66.916
4	88	165	77	3.08000	32.3	32.5319	-0.232	-0.718
5	165	298	133	1.72727	23.4	29.4378	-6.038	-25.802
6	298	500	202	1.51880	28.4	25.8406	2.559	9.012
7	500	601	101	0.50000	27.3	28.9358	-1.636	-5.992
8	601	640	39	0.38614	27.3	31.2731	-3.973	-14.554
9	640	702	62	1.38974	35.4	25.1993	10.201	28.816
10	702	742	40	0.64516	35.0	28.4990	6.501	18.574

B-58

NOTE: THE RESIDUAL SS HAS FAILED TO CONVERGE IN THE SPECIFIED NUMBER OF ITERATIONS.

LOT	XL	XU	YI	VI	AUC	UCP	DIF	PCT
1	0	17	17	1.00000	93.86	.	.	.
2	17	53	36	2.11765	80.26	.	.	.
3	53	73	20	0.55556	73.16	.	.	.
4	73	103	30	1.50000	36.56	.	.	.

D.4.2 - Fighter Aircraft Programs

A-10

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	5178340.26423691	1294585.06605923
RESIDUAL	5	8877.12016309	1775.42403262
UNCORRECTED TOTAL	9	5187217.38440000	
(CORRECTED TOTAL)	8	1226666.30488889	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	21.35945814	4.46447952	9.88331452	32.83560177
B	0.03551821	0.04450705	-0.07888915	0.14992557
C	-0.24674482	0.06019088	-0.40146817	-0.09202147
D	0.00564444	0.04542056	-0.11111113	0.12240001

LOT	XL	XU	YI	VI	AUC	UCP	DIF	PCT
1	0	22	22	1.00000	12.37	10.7369	1.6331	13.202
2	22	75	53	2.40909	9.16	9.2331	-0.0731	-0.798
3	75	95	20	0.37736	8.20	11.8761	-3.6761	-44.830
4	95	195	100	5.00000	8.20	8.2510	-0.0510	-0.622
5	195	339	144	1.44000	7.82	7.6546	0.1654	2.116
6	339	483	144	1.00000	7.59	7.7587	-0.1687	-2.222
7	483	627	144	1.00000	7.82	7.8425	-0.0225	-0.288
8	627	687	60	0.41667	10.18	9.7446	0.4354	4.277
9	687	707	20	0.33333	13.64	12.7897	0.8503	6.234

F-100

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SOUARES	MEAN SQUARE
REGRESSION	4	11806452.49031166	2951613.12257792
RESIDUAL	1	29188.37868834	29188.37868834
UNCORRECTED TOTAL	5	11835640.86900000	
(CORRECTED TOTAL)	4	2086478.76652000	

F-100 (Continued)

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	8.82253823	18.45628031	-225.68295938	243.32803584
B	-0.20243239	0.15766433	-2.20571542	1.80085064
C	0.05361309	0.38698372	-4.86340203	4.97062821
D	-0.05735368	0.09283349	-1.23689598	1.12218862

LOT	XL	XU	YI	VI	AUC	UCP	DIF	PCT
1	0	23	23	1.0000	6.51	6.93705	-0.42705	-6.5598
2	23	568	545	23.6957	3.45	3.44382	0.00618	0.1792
3	568	1161	593	1.0881	3.08	3.16101	-0.08101	-2.6301
4	1161	1720	559	0.9427	3.10	2.85527	0.24473	7.8944
5	1720	2277	557	0.9964	2.50	2.66116	-0.16116	-6.4465

F-101

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	7058523.71851614	1764630.92962903
RESIDUAL	2	18336.12608386	9168.06304193
UNCORRECTED TOTAL	6	7076859.84460000	
(CORRECTED TOTAL)	5	2200718.46433334	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	18.50077561	7.67500757	-14.52247947	51.52403070
B	-0.29904995	0.08708154	-0.67373570	0.07563581
C	0.13129396	0.14462309	-0.49097580	0.75356373
D	-0.07547397	0.09355644	-0.47801927	0.32707133

LOT	XL	XU	YI	VI	AUC	UCP	DIF	PCT
1	0	31	31	1.00000	16.85	14.8360	2.0140	11.952
2	31	115	84	2.70968	7.58	8.7207	-1.1407	-15.048
3	115	424	309	3.67857	6.91	6.8404	0.0696	1.008
4	424	630	206	0.66667	5.76	5.9076	-0.1476	-2.562
5	630	714	84	0.40777	5.27	5.0562	0.2138	4.057
6	714	807	93	1.10714	5.22	4.5795	0.6405	12.270

F-102

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	4462706.46600000	1115676.61650000
RESIDUAL	0	0.00000000	0.00000000
UNCORRECTED TOTAL	4	4462706.46600000	
(CORRECTED TOTAL)	3	1795723.51790000	

F-102 (Continued)

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	16.00990946	0	16.00990946	16.00990946
B	-0.45624686	0	-0.45624686	-0.45624686
C	0.19972436	0	0.19972436	0.19972436
D	-0.04924279	0	-0.04924279	-0.04924279

LOT	XL	XU	YI	VI	AUC	UCP	DIF	PCT
1	0	37	37	1.00000	11.66	11.66	2.66454E-15	2.28519E-14
2	37	145	108	2.91892	5.17	5.17	-1.77636E-15	-3.43589E-14
3	145	707	562	5.20370	3.50	3.50	2.22045E-16	6.34413E-15
4	707	847	140	0.24911	2.21	2.21	-6.66134E-16	-3.01418E-14

F-106

NOTE: THE RESIDUAL SS HAS FAILED TO CONVERGE IN THE SPECIFIED NUMBER OF ITERATIONS.

LOT	XL	XU	YI	VI	AUC	UCP	DIF	PCT
1	0	42	42	1.00000	34.19	.	.	.
2	42	130	88	2.09524	10.54	.	.	.
3	130	175	45	0.51136	11.64	.	.	.
4	175	340	165	3.66667	7.59	.	.	.

F-15A/B

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	10242106.64575090	2560526.66143772
RESIDUAL	2	5677.93915806	2838.96957903
UNCORRECTED TOTAL	6	10247784.58490896	
(CORRECTED TOTAL)	5	1585922.13232014	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	31.27660179	8.66085762	-5.98847028	68.54167386
B	-0.12948492	0.03576499	-0.28337093	0.02440108
C	0.01514677	0.09231404	-0.38205283	0.41234637
D	0.01921838	0.03357183	-0.12523115	0.16366790

LOT	XL	XU	YI	VI	AUC	UCP	DIF	PCT
1	0	30	30	1.00000	25.5970	24.3530	1.24403	4.8601
2	30	92	62	2.06667	19.5560	19.9641	-0.40809	-2.0868
3	92	164	72	1.16129	17.1838	17.8899	-0.70610	-4.1091
4	164	272	108	1.50000	17.1260	16.8761	0.24993	1.4593
5	272	296	24	0.22222	16.0210	15.3434	0.67756	4.2292
6	296	404	108	4.50000	16.2720	16.1960	0.07597	0.4669

F-15C/D

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	8408504.30912522	2102126.07728131
RESIDUAL	4	10636.97725486	2659.24431372
UNCORRECTED TOTAL	8	8419141.28638009	
(CORRECTED TOTAL)	7	752329.31026303	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	132.31017287	90.53213709	-119.04393503	383.66428077
B	-0.08074658	0.04408210	-0.20313645	0.04164329
C	-0.38325877	0.11645382	-0.70658204	-0.05993550
D	0.39851473	0.09944805	0.12240641	0.67462304

LOT	XL	XU	YI	VI	AUC	UCP	DIF	PCT
1	0	97	97	1.00000	17.2499	17.2300	0.0199	0.1154
2	97	175	78	0.80412	15.5880	15.3801	0.2079	1.3339
3	175	235	60	0.76923	15.5080	16.1496	-0.6416	-4.1375
4	235	277	42	0.70000	17.6650	17.5115	0.1535	0.8689
5	277	313	36	0.85714	19.9430	19.9086	0.0344	0.1724
6	313	352	39	1.08333	19.3080	20.9919	-1.6839	-8.7215
7	352	388	36	0.92308	21.9540	20.1333	1.8207	8.2933
8	388	436	48	1.33333	21.0170	20.6971	0.3199	1.5220

F-15E

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	14014282.45277952	3503570.61319488
RESIDUAL	2	18494.08386048	9247.04193024
UNCORRECTED TOTAL	6	14032776.53664000	
(CORRECTED TOTAL)	5	172346.38665600	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	256.44249608	448.44639418	-1673.08780414	2185.97279631
B	0.04802279	0.09386942	-0.35586917	0.45191475
C	-0.65974707	0.49690746	-2.79779079	1.47829665
D	0.24071764	0.26792042	-0.91206353	1.39349882

LOT	XL	XU	YI	VI	AUC	UCP	DIF	PCT
1	0	60	60	1.00000	20.544	19.9931	0.55086	2.6814
2	60	132	72	1.20000	19.203	19.8330	-0.63003	-3.2809
3	132	228	96	1.33333	17.608	17.3513	0.25672	1.4580
4	228	324	96	1.00000	16.175	16.5314	-0.35644	-2.2036
5	324	420	96	1.00000	16.041	16.7719	-0.73088	-4.5563
6	420	516	96	1.00000	17.927	16.9586	0.96840	5.4019

F-16A/B

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	5503720.72369400	1375930.18092350
RESIDUAL	1	74316.01630600	74316.01630600
UNCORRECTED TOTAL	5	5578036.74000000	
(CORRECTED TOTAL)	4	338023.54800000	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	14.38697684	89.09406567	-1117.64222154	1146.41617521
B	-0.21594272	0.27968315	-3.76959686	3.33771142
C	0.08854649	1.51984208	-19.22256692	19.39965990
D	0.34640500	0.92179332	-11.36590087	12.05871086

LOT	XL	XU	YI	VI	AUC	UCP	DIF	PCT
1	0	105	105	1.00000	10.14	10.1421	-0.00215	-0.021
2	105	250	145	1.38095	7.74	8.2333	-0.49334	-6.374
3	250	425	175	1.20690	8.04	6.9218	1.11821	13.908
4	425	605	180	1.02857	5.05	5.9827	-0.93268	-18.469
5	605	725	120	0.66667	5.13	4.6953	0.43471	8.474

F-16E

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	47708885.13447254	11927221.28361814
RESIDUAL	6	307960.48832744	51326.74805457
UNCORRECTED TOTAL	10	48016845.62279998	
(CORRECTED TOTAL)	9	1747028.76516001	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	36.18364759	72.46593654	-141.13423931	213.50153450
B	0.03836656	0.10316626	-0.21407235	0.29080548
C	-0.27359630	0.49471233	-1.48411464	0.93692205
D	0.29524082	0.33990100	-0.53646755	1.12694920

LOT	XL	XU	YI	VI	AUC	UCP	DIF	PCT
1	0	120	120	1.00000	9.86	11.2999	-1.4399	-14.604
2	120	264	144	1.20000	10.58	11.9834	-1.4034	-13.265
3	264	414	150	1.04167	14.55	11.6230	2.9270	20.117
4	414	630	216	1.44000	11.93	11.7685	0.1615	1.354
5	630	846	216	1.00000	11.28	10.7101	0.5699	5.052
6	846	1062	216	1.00000	11.02	10.8167	0.2033	1.845
7	1062	1278	216	1.00000	10.88	10.9020	-0.0220	-0.202
8	1278	1494	216	1.00000	10.69	10.9733	-0.2833	-2.650
9	1494	1710	216	1.00000	10.61	11.0345	-0.4245	-4.001
10	1710	1926	216	1.00000	10.54	11.0883	-0.5483	-5.202

D.4.3 - Electronics Programs

ARC-109V

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	66.70959155	16.67739789
RESIDUAL	1	0.03448218	0.03448218
UNCORRECTED TOTAL	5	66.74407373	
(CORRECTED TOTAL)	4	29.01018283	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	0.00628877	0.00730382	-0.08651352	0.09909105
B	1.78353883	1.14400890	-12.75223830	16.31931595
C	-1.73520051	1.10000742	-15.71189481	12.24149379
D	1.26601455	0.75302832	-8.30196331	10.83399241

LOT	XL	XU	YI	VI	AUC	UCP	DIF	PCT
1	0	4	4	1.00000	0.0487	0.0024159	0.0462841	95.0393
2	4	28	24	6.00000	0.0393	0.0389270	0.0003730	0.9490
3	28	107	79	3.29167	0.0285	0.0286400	-0.0001400	-0.4912
4	107	333	226	2.86076	0.0313	0.0312910	0.0000090	0.0288
5	333	441	108	0.47788	0.0303	0.0302987	0.0000013	0.0042

ARC-54

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	4665.06979969	1166.26744992
RESIDUAL	3	1.13114301	0.37704767
UNCORRECTED TOTAL	7	4666.20094270	
(CORRECTED TOTAL)	6	1109.40696153	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	0.02419572	0.00551851	0.00663307	0.04175837
B	-0.15047506	0.01978001	-0.21342494	-0.08752518
C	0.10618287	0.04752360	-0.04506099	0.25742673
D	-0.04082382	0.01123598	-0.07658234	-0.00506530

LOT	XL	XU	YI	VI	AUC	UCP	DIF	PCT
1	0	900	900	1.0000	0.0210	0.0210723	-0.00007233	-0.3444
2	900	1753	853	0.9478	0.0165	0.0168794	-0.00037943	-2.2996
3	1753	3134	1381	1.6190	0.0164	0.0158434	0.00055663	3.3941
4	3134	4294	1160	0.8400	0.0145	0.0149747	-0.00047474	-3.2740
5	4294	4594	300	0.2586	0.0144	0.0132391	0.00116088	8.0617
6	4594	7697	3103	10.3433	0.0139	0.0139257	-0.00002567	-0.1847
7	7697	10347	2650	0.8540	0.0143	0.0142930	0.00000697	0.0487

ASN-63

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	27721.55758646	6930.38939661
RESIDUAL	6	20.40740965	3.40123494
UNCORRECTED TOTAL	10	27741.96499611	
(CORRECTED TOTAL)	9	14794.09415689	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	3.03565086	3.70510667	-6.03042511	12.10172682
B	-0.22261461	0.09427545	-0.45329849	0.00806927
C	-0.23410559	0.10758262	-0.49735097	0.02913980
D	0.10810586	0.05300724	-0.02159828	0.23781001

LOT	XL	XU	YI	VI	AUC	UCP	DIF	PCT
1	0	781	781	1.00000	0.1866	0.186416	0.000184	0.099
2	781	930	149	0.19078	0.1744	0.175030	-0.000630	-0.361
3	930	1217	287	1.92617	0.1769	0.183349	-0.006449	-3.646
4	1217	1358	141	0.49129	0.1817	0.179276	0.002424	1.334
5	1358	1450	92	0.65248	0.1772	0.200375	-0.023175	-13.078
6	1450	1585	135	1.46739	0.2189	0.196520	0.022380	10.224
7	1585	1693	108	0.80000	0.1911	0.190611	0.000489	0.256
8	1693	1851	158	1.46296	0.1917	0.182928	0.008772	4.576
9	1851	1887	36	0.22785	0.2005	0.209009	-0.008509	-4.244
10	1887	1923	36	1.00000	0.2145	0.244209	-0.029709	-13.850

ASN-70

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	119.45329142	29.86332285
RESIDUAL	4	0.00270739	0.00067685
UNCORRECTED TOTAL	8	119.45599881	
(CORRECTED TOTAL)	7	64.18968336	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	0.04282079	0.00229422	0.03645110	0.04919047
B	0.00251757	0.00330946	-0.00667083	0.01170596
C	-0.04211858	0.00982873	-0.06940715	-0.01483002
D	0.05038984	0.01032503	0.02172336	0.07905632

ASN-70 (Continued)

LOT	XL	XU	YI	VI	AUC	UCP	DIF	PCT
1	0	152	152	1.00000	0.0350	0.0350074	-0.0000074	-0.0210
2	152	402	250	1.64474	0.0353	0.0352903	0.0000097	0.0275
3	402	483	81	0.32400	0.0342	0.0341404	0.0000596	0.1744
4	483	541	58	0.71605	0.0356	0.0360489	-0.0004489	-1.2610
5	541	567	26	0.44828	0.0370	0.0364256	0.0005744	1.5525
6	567	575	8	0.30769	0.0399	0.0375633	0.0023367	5.8563
7	575	583	8	1.00000	0.0370	0.0398633	-0.0028633	-7.7386
8	583	594	11	1.37500	0.0427	0.0399701	0.0027299	6.3933

ASN-99

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	380.95545761	95.23886440
RESIDUAL	4	2.64815153	0.66203788
UNCORRECTED TOTAL	8	383.60360914	
(CORRECTED TOTAL)	7	61.21154176	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL	
			LOWER	UPPER
A	0.18881938	0.12401662	-0.15550130	0.53314005
B	0.03395446	0.05487169	-0.11839171	0.18630063
C	-0.31999619	0.10378866	-0.60815581	-0.03183657
D	0.18007143	0.12179808	-0.15808969	0.51823254

LOT	XL	XU	YI	VI	AUC	UCP	DIF	PCT
1	0	157	157	1.00000	0.0464	0.0429958	0.003404	7.337
2	157	353	196	1.24841	0.0404	0.0437754	-0.003375	-8.355
3	353	538	185	0.94388	0.0413	0.0432394	-0.001939	-4.696
4	538	781	243	1.31351	0.0433	0.0426218	0.000678	1.566
5	781	805	24	0.09877	0.0570	0.0564656	0.000534	0.938
6	805	877	72	3.00000	0.0624	0.0736086	-0.011209	-17.963
7	877	933	56	0.77778	0.0635	0.0627146	0.000785	1.237
8	933	1050	117	2.08929	0.0684	0.0593727	0.009027	13.198

CP-1035N

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	208.80394327	52.20098582
RESIDUAL	2	0.44420893	0.22210447
UNCORRECTED TOTAL	6	209.24815220	
(CORRECTED TOTAL)	5	41.36682739	

CP-1035N (Continued)

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	0.08283220	0.06880478	-0.21321411	0.37887851
B	-0.12335010	0.21895389	-1.06544302	0.81874282
C	0.27038696	0.47120486	-1.75706618	2.29784010
D	-0.35339667	0.25680826	-1.45836556	0.75157221

LOT	XL	XU	YI	VI	AUC	UCP	DIF	PCT
1	0	12	12	1.00000	0.1248	0.136161	-0.011361	-9.103
2	12	38	26	2.16667	0.0903	0.102960	-0.012660	-14.020
3	38	86	48	1.84615	0.1236	0.114598	0.009002	7.283
4	86	134	48	1.00000	0.1287	0.132271	-0.003571	-2.774
5	134	184	50	1.04167	0.1310	0.125899	0.005101	3.894
6	184	264	80	1.60000	0.1154	0.117775	-0.002375	-2.058

LANTIRN (Navigation Pod)

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	87339.20363733	21834.80090933
RESIDUAL	3	0.02725859	0.00908620
UNCORRECTED TOTAL	7	87339.23089592	
(CORRECTED TOTAL)	6	17386.82280392	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	1.86188239	0.01473683	1.81498243	1.90878235
B	-0.11345523	0.00108077	-0.11689480	-0.11001567
C	-0.00614745	0.00156986	-0.01114353	-0.00115138
D	0.00156327	0.00122988	-0.00235082	0.00547736

LOT	XL	XU	YI	VI	AUC	UCP	DIF	PCT
1	0	4	4	1.00000	1.7500	1.77928	-0.029277	-1.6730
2	4	38	34	8.50000	1.3199	1.31803	0.001867	0.1415
3	38	176	138	4.05882	1.0761	1.07634	-0.000243	-0.0226
4	176	320	144	1.04348	0.9679	0.96793	-0.000026	-0.0026
5	320	464	144	1.00000	0.9184	0.91785	0.000546	0.0594
6	464	608	144	1.00000	0.8854	0.88555	-0.000147	-0.0166
7	608	724	116	0.80556	0.8643	0.86466	-0.000361	-0.0418

LANTIRN (Target Pod)

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	64803.79972529	16200.94993132
RESIDUAL	3	0.08104959	0.02701653
UNCORRECTED TOTAL	7	64803.88077488	
(CORRECTED TOTAL)	6	12795.42099227	

LANTIRN (Continued)

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	1.54338327	0.02747695	1.45593788	1.63082866
B	-0.10503907	0.00230969	-0.11238966	-0.09768849
C	-0.00497508	0.00327650	-0.01540255	0.00545240
D	0.00231719	0.00285996	-0.00678462	0.01141900

LOT	XL	XU	YI	VI	AUC	UCP	DIF	PCT
1	0	4	4	1.00000	1.4375	1.48059	-0.043089	-2.9975
2	4	38	34	8.50000	1.1286	1.12568	0.002917	0.2584
3	38	166	128	3.76471	0.9375	0.93793	-0.000429	-0.0458
4	166	310	144	1.12500	0.8490	0.84921	-0.000206	-0.0243
5	310	454	144	1.00000	0.8081	0.80690	0.001199	0.1484
6	454	598	144	1.00000	0.7795	0.77998	-0.000482	-0.0618
7	598	714	116	0.80556	0.7619	0.76237	-0.000471	-0.0618

LANTIRN (Target Recognizer)

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	11937.34203081	2984.33550770
RESIDUAL	1	1.05443569	1.05443569
UNCORRECTED TOTAL	5	11938.39646650	
(CORRECTED TOTAL)	4	1483.53065817	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	0.69135038	0.17859705	-1.57790374	2.96060450
B	-0.14346301	0.02405778	-0.44914121	0.16221520
C	0.00235151	0.07332859	-0.92936153	0.93406455
D	-0.00280978	0.04037163	-0.51577176	0.51015220

LOT	XL	XU	YI	VI	AUC	UCP	DIF	PCT
1	0	79	79	1.00000	0.4383	0.435687	0.0026125	0.5961
2	79	271	192	2.43038	0.3353	0.335874	-0.0005737	-0.1711
3	271	463	192	1.00000	0.2975	0.300583	-0.0030826	-1.0362
4	463	655	192	1.00000	0.2865	0.282663	0.0038369	1.3392
5	655	720	65	0.33854	0.2693	0.274325	-0.0050253	-1.8661

ASQ-133

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	2907.07707188	726.76926797
RESIDUAL	2	2.49690878	1.24845439
UNCORRECTED TOTAL	6	2909.57398066	
(CORRECTED TOTAL)	5	411.15312705	

ASQ-133 (Continued)

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	1.03911154	0.31987025	-0.33719417	2.41541725
B	-0.10494376	0.07676268	-0.43523055	0.22534303
C	-0.12043941	0.15231854	-0.77582038	0.53494155
D	0.04690540	0.07423800	-0.27251846	0.36632926

LOT	XL	XU	YI	VI	AUC	UCP	DIF	PCT
1	0	14	14	1.00000	0.5856	0.640463	-0.054863	-9.3686
2	14	33	19	1.35714	0.5862	0.532641	0.053559	9.1366
3	33	102	69	3.63158	0.4255	0.428442	-0.002942	-0.6914
4	102	169	67	0.97101	0.3828	0.374043	0.008757	2.2877
5	169	250	81	1.20896	0.3535	0.352691	0.000809	0.2288
6	250	308	58	0.71605	0.3355	0.347466	-0.011966	-3.5666

ASN-108

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	560.26170298	140.06542574
RESIDUAL	1	0.36889226	0.36889226
UNCORRECTED TOTAL	5	560.63059524	
(CORRECTED TOTAL)	4	226.66710333	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	0.08812506	0.02924381	-0.28344676	0.45969689
B	-0.23922499	0.35577036	-4.75964315	4.28119318
C	0.27900232	0.41936099	-5.04939836	5.60740300
D	-0.14807154	0.29041674	-3.83810658	3.54196350

LOT	XL	XU	YI	VI	AUC	UCP	DIF	PCT
1	0	8	8	1.00000	0.1373	0.125825	0.0114755	8.3580
2	8	39	31	3.87500	0.1048	0.090621	0.0141789	13.5295
3	39	116	77	2.48387	0.0874	0.092632	-0.0052324	-5.9868
4	116	332	216	2.80519	0.0943	0.094034	0.0002662	0.2823
5	332	440	108	0.50000	0.0872	0.086826	0.0003740	0.4289

ASW-32

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	296.93770716	74.23442679
RESIDUAL	2	3.94036652	1.97018326
UNCORRECTED TOTAL	6	300.87807368	
(CORRECTED TOTAL)	5	54.90298664	

ASW-32 (Continued)

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	0.28855622	0.51166292	-1.91297582	2.49008825
B	0.29652963	0.60965183	-2.32661931	2.91967856
C	-0.58657505	1.17592674	-5.64623502	4.47308491
D	0.65443333	0.66158438	-2.19216578	3.50103244

LOT	XL	XU	YI	VI	AUC	UCP	DIF	PCT
1	0	12	12	1.00000	0.2338	0.108252	0.125548	53.699
2	12	38	26	2.16667	0.1643	0.182026	-0.017726	-10.789
3	38	86	48	1.84615	0.1524	0.150472	0.001928	1.265
4	86	134	48	1.00000	0.0974	0.119857	-0.022457	-23.056
5	134	184	50	1.04167	0.1441	0.134172	0.009928	6.889
6	184	264	80	1.60000	0.1518	0.149259	0.002541	1.674

JTIDS

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS SOURCE	DF	SUM OF SQUARES	DEPENDENT VARIABLE TCA MEAN SQUARE
REGRESSION	4	1571.02945796	392.75736449
RESIDUAL	1	0.01258025	0.01258025
UNCORRECTED TOTAL	5	1571.04203821	
(CORRECTED TOTAL)	4	40.25750283	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	0.75127178	0.09099195	-0.40487195	1.90741552
B	-0.20562967	0.00639136	-0.28683830	-0.12442105
C	-0.01607588	0.03546496	-0.46669362	0.43454185
D	-0.05908038	0.01991781	-0.31215607	0.19399531

LOT	XL	XU	YI	VI	AUC	UCP	DIF	PCT
1	0	45	45	1.00000	0.4068	0.406675	0.00012487	0.03070
2	45	121	76	1.68889	0.2764	0.276408	-0.00000847	-0.00306
3	121	198	77	1.01316	0.2466	0.247314	-0.00071368	-0.28941
4	198	270	72	0.93506	0.2308	0.229567	0.00123349	0.53444
5	270	327	57	0.79167	0.2205	0.221211	-0.00071068	-0.32230

D.4.4 - Helicopter Programs

HH-52

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS SOURCE	DF	SUM OF SQUARES	DEPENDENT VARIABLE TCA MEAN SQUARE
REGRESSION	4	3110.85462205	777.71365551
RESIDUAL	2	0.10740295	0.05370147
UNCORRECTED TOTAL	6	3110.96202500	
(CORRECTED TOTAL)	5	731.19918350	

HH-52 (Continued)

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	30.75524071	12.10089619	-21.31128532	82.82176674
B	-0.38771775	0.02754433	-0.50623275	-0.26920275
C	-0.65108214	0.10402085	-1.09865265	-0.20351163
D	0.28669994	0.03535418	0.13458153	0.43881835

LOT	XL	XU	YI	VI	AUC	UCP	DIF	PCT
1	0	28	28	1.00000	1.577	1.57637	0.000634	0.0402
2	28	43	15	0.53571	1.104	1.10966	-0.005655	-0.5123
3	43	60	17	1.13333	1.085	1.09586	-0.010856	-1.0006
4	60	75	15	0.88235	1.012	0.99502	0.016979	1.6778
5	75	87	12	0.80000	1.041	1.04174	-0.000742	-0.0712
6	87	99	12	1.00000	1.055	1.05252	0.002481	0.2351

CH-46

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	358397.03972511	89599.25993128
RESIDUAL	4	1215.97943589	303.99485897
UNCORRECTED TOTAL	8	359613.01916100	
(CORRECTED TOTAL)	7	57764.44745087	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	13.76121587	3.41408475	4.28232522	23.24010651
B	-0.12026961	0.07334555	-0.32390674	0.08336752
C	-0.23842663	0.11734345	-0.56421986	0.08736660
D	-0.01058721	0.10347076	-0.29786421	0.27668979

LOT	XL	XU	YI	VI	AUC	UCP	DIF	PCT
1	0	14	14	1.00000	7.541	6.07009	1.47091	19.505
2	14	50	36	2.57143	3.898	3.85199	0.04601	1.180
3	50	110	60	1.66667	2.766	3.05424	-0.28824	-10.421
4	110	195	85	1.41667	2.419	2.60152	-0.18252	-7.545
5	195	394	199	2.34118	1.986	1.95361	0.03239	1.631
6	394	486	92	0.46231	2.236	2.27073	-0.03473	-1.553
7	486	576	90	0.97826	2.370	2.21380	0.15620	6.591
8	576	624	48	0.53333	2.547	2.55025	-0.00325	-0.128

H-53

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	618957.70332353	154739.42583088
RESIDUAL	4	121.06193646	30.26548412
UNCORRECTED TOTAL	8	619078.76526000	
(CORRECTED TOTAL)	7	355155.11827950	

H-53 (Continued)

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	7.73460623	0.89331231	5.25440720	10.21480527
B	-0.13495600	0.01790055	-0.18465523	-0.08525678
C	-0.00032662	0.01805556	-0.05045621	0.04980297
D	-0.01417067	0.01011451	-0.04225268	0.01391134

LOT	XL	XU	YI	VI	AUC	UCP	DIF	PCT
1	0	10	10	1.0000	6.752	6.54813	0.20387	3.019
2	10	141	131	13.1000	4.264	4.26932	-0.00532	-0.125
3	141	281	140	1.0687	3.762	3.75767	0.00433	0.115
4	281	293	12	0.0857	3.382	3.72824	-0.34624	-10.238
5	293	323	30	2.5000	3.341	3.51964	-0.17864	-5.347
6	323	331	8	0.2667	3.154	3.60517	-0.45117	-14.305
7	331	361	30	3.7500	3.685	3.44492	0.24008	6.515
8	361	367	6	0.2000	3.947	3.56824	0.37876	9.596

CH-47

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	481348.05348623	120337.01337156
RESIDUAL	8	4512.48150377	564.06018797
UNCORRECTED TOTAL	12	485860.53499000	
(CORRECTED TOTAL)	11	132801.70813367	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	14.14693712	3.95776232	5.02023279	23.27364145
B	-0.03900031	0.06011792	-0.17763383	0.09963321
C	-0.31832191	0.09529038	-0.53806404	-0.09857977
D	0.09752169	0.09398514	-0.11921052	0.31425390

LOT	XL	XU	YI	VI	AUC	UCP	DIF	PCT
1	0	18	18	1.00000	6.181	5.24086	0.9401	15.210
2	18	42	24	1.33333	5.226	4.63854	0.5875	11.241
3	42	66	24	1.00000	4.559	4.40447	0.1545	3.389
4	66	126	60	2.50000	3.459	3.51910	-0.0601	-1.738
5	126	198	72	1.20000	2.760	3.02782	-0.2678	-9.704
6	198	358	160	2.22222	2.307	2.44227	-0.1353	-5.863
7	358	442	84	0.52500	2.313	2.56675	-0.2537	-10.970
8	442	585	143	1.70238	2.695	2.40686	0.2881	10.692
9	585	630	45	0.31469	3.463	2.93012	0.5329	15.388
10	630	666	36	0.80000	3.085	3.43682	-0.3518	-11.404
11	666	678	12	0.33333	3.671	4.47031	-0.7993	-21.774
12	678	690	12	1.00000	3.852	4.97242	-1.1204	-29.087

H-54

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	21003.61777722	5250.90444431
RESIDUAL	1	125.17113078	125.17113078
UNCORRECTED TOTAL	5	21128.78890800	
(CORRECTED TOTAL)	4	3891.65021280	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	7.78380637	5.07726374	-56.72790668	72.29551942
B	-0.05692101	0.20312144	-2.63778196	2.52393995
C	-0.21887086	0.35605422	-4.74289580	4.30515409
D	0.01071513	0.21996000	-2.78409664	2.80552691

LOT	XL	XU	YI	VI	AUC	UCP	DIF	PCT
1	0	6	6	1.00000	5.248	5.03543	0.21257	4.051
2	6	30	24	4.00000	3.388	3.36035	0.02765	0.816
3	30	60	30	1.25000	2.801	2.98766	-0.18666	-6.664
4	60	83	23	0.76667	3.402	3.06533	0.33667	9.896
5	83	89	6	0.26087	3.083	4.02268	-0.93968	-30.480

HH-60D

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	123892.22000000	30973.05500000
RESIDUAL	0	0.00000000	0.00000000
UNCORRECTED TOTAL	4	123892.22000000	
(CORRECTED TOTAL)	3	24351.97000000	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	9.70408586	0	9.70408586	9.70408586
B	-0.05434118	0	-0.05434118	-0.05434118
C	-0.04507231	0	-0.04507231	-0.04507231
D	-0.01252697	0	-0.01252697	-0.01252697

LOT	XL	XU	YI	VI	AUC	UCP	DIF	PCT
1	0	3	3	1.00000	9.2	9.2	6.66134E-16	7.24058E-15
2	3	28	25	8.33333	7.1	7.1	0	0
3	28	63	35	1.40000	6.7	6.7	-2.22045E-16	-3.31410E-15
4	63	92	29	0.82857	6.6	6.6	1.11022E-15	1.68216E-14

SH-3

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	72691.65151721	18172.91287930
RESIDUAL	5	284.66202479	56.93240496
UNCORRECTED TOTAL	9	72976.31354200	
(CORRECTED TOTAL)	8	13013.69066156	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	3.23766537	1.09132770	0.43235888	6.04297187
B	-0.17062823	0.03648443	-0.26441308	-0.07684337
C	0.09850212	0.10006275	-0.15871363	0.35571787
D	0.02557295	0.08393492	-0.19018551	0.24133142

LOT	XL	XU	YI	VI	AUC	UCP	DIF	PCT
1	0	20	20	1.00000	3.327	3.14517	0.18183	5.465
2	20	69	49	2.45000	2.480	2.57226	-0.09226	-3.720
3	69	140	71	1.44898	2.319	2.25902	0.05998	2.586
4	140	185	45	0.63380	1.811	1.95460	-0.14360	-7.929
5	185	221	36	0.80000	1.870	1.85116	0.01884	1.008
6	221	257	36	1.00000	1.589	1.81047	-0.22147	-13.938
7	257	287	30	0.83333	1.703	1.73119	-0.02819	-1.655
8	287	335	48	1.60000	1.930	1.80222	0.12778	6.621
9	335	350	15	0.31250	2.144	1.51595	0.62805	29.294

D.4.5 - Tactical Armaments Programs

LLLGB

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	220658983277.46260	55164745819.36565
RESIDUAL	6	7434215.53732	1239035.92289
UNCORRECTED TOTAL	10	220666417492.99991	
(CORRECTED TOTAL)	9	31936246324.90007	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	83.33494802	6.33409570	67.83596299	98.83393305
B	-0.16924444	0.00956974	-0.19266077	-0.14582812
C	-0.00424544	0.01691239	-0.04562861	0.03713772
D	-0.00135156	0.01377812	-0.03506543	0.03236232

LLLGB (Continued)

LOT	XL	XU	YI	VI	AUC	UCP	DIF	PCT
1	0	1600	1600	1.00000	27.5	27.8915	-0.39148	-1.4236
2	1600	4550	2950	1.84375	20.6	20.8457	-0.24569	-1.1927
3	4550	8290	3740	1.26780	18.9	18.2964	0.60359	3.1936
4	8290	17270	8980	2.40107	16.2	16.2318	-0.03179	-0.1962
5	17270	26890	9620	1.07127	14.7	14.7696	-0.06962	-0.4736
6	26890	41290	14400	1.49688	13.7	13.6919	0.00813	0.0593
7	41290	56890	15600	1.08333	12.9	12.8653	0.03474	0.2693
8	56890	72490	15600	1.00000	12.3	12.2752	0.02484	0.2019
9	72490	88090	15600	1.00000	11.8	11.8324	-0.03244	-0.2749
10	88090	100000	11910	0.76346	11.5	11.5353	-0.03532	-0.3071

CEM

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	1106751230519.5583	276687807629.8896
RESIDUAL	4	361968375.1936	90492093.7984
UNCORRECTED TOTAL	8	1107113198894.7521	
(CORRECTED TOTAL)	7	367517125638.9579	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	69.37726692	21.71298821	9.09316276	129.66137108
B	-0.33981493	0.07689212	-0.55329880	-0.12633105
C	0.21212281	0.09350613	-0.04748833	0.47173394
D	-0.15428027	0.08737641	-0.39687278	0.08831225

LOT	XL	XU	YI	VI	AUC	UCP	DIF	PCT
1	0	172	172	1.00000	69.24	54.4618	14.7782	21.3435
2	172	1432	1260	7.32558	30.38	25.4581	4.9219	16.2012
3	1432	7557	6125	4.86111	19.88	20.7045	-0.8245	-4.1474
4	7557	21777	14220	2.32163	17.65	18.1302	-0.4802	-2.7208
5	21777	50227	28450	2.00070	16.19	15.7293	0.4607	2.8455
6	50227	85247	35020	1.23093	14.01	14.1879	-0.1779	-1.2698
7	85247	134157	48910	1.39663	12.58	12.6616	-0.0816	-0.6488
8	134157	171666	37509	0.76690	11.81	11.6957	0.1143	0.9677

GBU-15

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	39960281281.689314	9990070320.422327
RESIDUAL	5	120004955.310674	24000991.062135
UNCORRECTED TOTAL	9	40080286236.999989	
(CORRECTED TOTAL)	8	10225399631.555555	

GBU-15 (Continued)

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	36.55077277	26.81576797	-32.38035420	105.48189974
B	-0.24770302	0.13750571	-0.60116759	0.10576155
C	0.52335564	0.24541684	-0.10749928	1.15421056
D	-0.13853280	0.12741881	-0.46606854	0.18900293

LOT	XL	XU	YI	VI	AUC	UCP	DIF	PCT
1	0	40	40	1.00000	197.5	134.313	63.187	31.9932
2	40	105	65	1.62500	200.0	106.295	93.705	46.8526
3	105	445	340	5.23077	143.9	156.291	-12.391	-8.6107
4	445	695	250	0.73529	148.3	142.832	5.468	3.6868
5	695	1015	320	1.28000	130.8	136.039	-5.239	-4.0057
6	1015	1615	600	1.87500	171.8	161.308	10.492	6.1070
7	1615	2215	600	1.00000	153.9	160.106	-6.206	-4.0326
8	2215	2815	600	1.00000	148.3	149.573	-1.273	-0.8586
9	2815	3415	600	1.00000	142.0	141.816	0.184	0.1295

D.4.6 - Tactical Missile Programs

AMRAAM

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	3264495.12924721	816123.78231180
RESIDUAL	6	1425.39960578	237.56660096
UNCORRECTED TOTAL	10	3265920.52885300	
(CORRECTED TOTAL)	9	185036.68624890	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	5.18086262	1.14334610	2.38319348	7.97853176
B	-0.34393868	0.02080659	-0.39485060	-0.29302676
C	-0.00921006	0.04650730	-0.12300940	0.10458929
D	-0.02573498	0.02590133	-0.08911329	0.03764333

LOT	XL	XU	YI	VI	AUC	UCP	DIF	PCT
1	0	194	194	1.00000	1.223	1.22892	-0.0059183	-0.4839
2	194	1251	1057	5.44845	0.512	0.50948	0.0025190	0.4920
3	1251	3215	1964	1.85809	0.342	0.34064	0.0013565	0.3966
4	3215	6211	2996	1.52546	0.257	0.26169	-0.0046867	-1.8236
5	6211	9111	2900	0.96796	0.232	0.22291	0.0090871	3.9169
6	9111	12011	2900	1.00000	0.194	0.19918	-0.0051775	-2.6688
7	12011	14911	2900	1.00000	0.182	0.18313	-0.0011275	-0.6195
8	14911	17911	3000	1.03448	0.170	0.17082	-0.0008170	-0.4806
9	17911	20911	3000	1.00000	0.158	0.16134	-0.0033438	-2.1163
10	20911	24674	3763	1.25433	0.155	0.15148	0.0035205	2.2713

HARM

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS — DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	1581071.70344435	395267.92586109
RESIDUAL	7	363.60764865	51.94394981
UNCORRECTED TOTAL	11	1581435.31109300	
(CORRECTED TOTAL)	10	341122.41543764	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	2.03568675	0.20959327	1.54007345	2.53130006
B	-0.18515676	0.02027497	-0.23309983	-0.13721368
C	-0.08458379	0.03036973	-0.15639737	-0.01277021
D	-0.02293087	0.02766013	-0.08833721	0.04247546

LOT	XL	XU	YI	VI	AUC	UCP	DIF	PCT
1	0	80	80	1.00000	0.809	0.766119	0.0428808	5.3005
2	80	316	236	2.95000	0.517	0.476914	0.0400859	7.7536
3	316	712	396	1.67797	0.400	0.384027	0.0159725	3.9931
4	712	1399	687	1.73485	0.314	0.320033	-0.0060329	-1.9213
5	1399	3144	1745	2.54003	0.249	0.254828	-0.0058280	-2.3406
6	3144	5612	2468	1.41433	0.223	0.221519	0.0014811	0.6642
7	5612	7731	2119	0.85859	0.208	0.209515	-0.0015153	-0.7285
8	7731	9863	2132	1.00613	0.197	0.198154	-0.0011540	-0.5858
9	9863	12863	3000	1.40713	0.184	0.182212	0.0017876	0.9715
10	12863	15863	3000	1.00000	0.177	0.175806	0.0011936	0.6743
11	15863	16961	1098	0.36600	0.186	0.191024	-0.0050237	-2.7009

IIR-MAVERICK

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS — DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	2028117.16072412	507029.29018103
RESIDUAL	5	3346.94458488	669.38891698
UNCORRECTED TOTAL	9	2031464.10530900	
(CORRECTED TOTAL)	8	458719.86902800	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	0.87275771	0.44761981	-0.27786898	2.02338439
B	-0.14867130	0.12125160	-0.46035396	0.16301135
C	-0.12858557	0.12258034	-0.44368380	0.18651267
D	-0.04976095	0.19076791	-0.54013837	0.44061647

IIR-MAVERICK (Continued)

LOT	XL	XU	YI	VI	AUC	UCP	DIF	PCT
1	0	200	200	1.00000	0.309	0.235950	0.073050	23.641
2	200	1100	900	4.50000	0.135	0.131063	0.003937	2.916
3	1100	3700	2600	2.88889	0.083	0.095575	-0.012575	-15.151
4	3700	9429	5729	2.20346	0.082	0.075092	0.006908	8.425
5	9429	18429	9000	1.57095	0.062	0.064258	-0.002258	-3.642
6	18429	30429	12000	1.33333	0.057	0.057353	-0.000353	-0.620
7	30429	42429	12000	1.00000	0.055	0.054771	0.000229	0.416
8	42429	54429	12000	1.00000	0.053	0.052483	0.000517	0.975
9	54429	60664	6235	0.51958	0.057	0.057470	-0.000470	-0.824

AIM-7FR

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	114995.95510618	28748.98877655
RESIDUAL	4	155.62979382	38.90744845
UNCORRECTED TOTAL	8	115151.58490000	
(CORRECTED TOTAL)	7	6543.29278750	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	3.70662280	1.23321799	0.28270708	7.13053853
B	-0.34527075	0.05327718	-0.49318991	-0.19735158
C	-0.08954996	0.10388143	-0.37796713	0.19886722
D	-0.09684778	0.06244069	-0.27020860	0.07651303

LOT	XL	XU	YI	VI	AUC	UCP	DIF	PCT
1	0	100	100	1.00000	0.741	0.764319	-0.023319	-3.1470
2	100	325	225	2.25000	0.378	0.339775	0.038225	10.1125
3	325	925	600	2.66667	0.199	0.209930	-0.010930	-5.4923
4	925	1725	800	1.33333	0.169	0.166750	0.002250	1.3316
5	1725	2825	1100	1.37500	0.134	0.133711	0.000289	0.2157
6	2825	4225	1400	1.27273	0.116	0.113165	0.002835	2.4436
7	4225	5125	900	0.64286	0.111	0.113829	-0.002829	-2.5489
8	5125	6269	1144	1.27111	0.095	0.097416	-0.002416	-2.5435

AIM-7FGD

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	28547.72883907	7136.93220977
RESIDUAL	2	73.42918593	36.71459297
UNCORRECTED TOTAL	6	28621.15802500	
(CORRECTED TOTAL)	5	7732.20792083	

AIM-7FGD (Continued)

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	2.35339669	0.92370737	-1.62103899	6.32783237
B	-0.44725018	0.18362113	-1.23731682	0.34281646
C	0.02175302	0.23667787	-0.99660085	1.04010689
D	-0.06146859	0.09889817	-0.48699774	0.36406056

LOT	XL	XU	YI	VI	AUC	UCP	DIF	PCT
1	0	15	15	1.00000	1.551	1.34502	0.205976	13.280
2	15	85	70	4.66667	0.379	0.43612	-0.057119	-15.071
3	85	295	210	3.00000	0.228	0.24545	-0.017450	-7.654
4	295	505	210	1.00000	0.195	0.18271	0.012294	6.305
5	505	1255	750	3.57143	0.130	0.12373	0.006270	4.823
6	1255	2565	1310	1.74667	0.090	0.09182	-0.001820	-2.023

D.5 - Alternative 2 SAS Results

This section presents the results of the SAS computer runs for alternative number two.

D.5.1 - Bomber Aircraft Programs

B-1B

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	59472026.76016220	14868006.69004055
RESIDUAL	1	5950.04983779	5950.04983779
UNCORRECTED TOTAL	5	59477976.80999999	
(CORRECTED TOTAL)	4	17234615.03200000	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	370.59732379	25.51925158	46.34971319	694.84493440
B	-0.23476073	0.04421466	-0.79655224	0.32703078
C	-0.00168154	0.00157385	-0.02167888	0.01831581
D	0.00001573	0.00002099	-0.00025103	0.00028248

B-1B (Continued)

LOT	XL	XU	YI	AUC	UCP	DIF	PCT
1	0	1	1	535.8	485.344	50.4562	9.4170
2	1	8	7	260.3	266.660	-6.3602	-2.4434
3	8	18	10	200.5	196.762	3.7381	1.8644
4	18	52	34	142.0	142.139	-0.1395	-0.0982
5	52	100	48	111.3	111.269	0.0311	0.0280

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS — DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	70399477.25015372	17599869.31253843
RESIDUAL	6	2001294.65984626	333549.10997438
UNCORRECTED TOTAL	10	72400771.90999997	
(CORRECTED TOTAL)	9	18070289.98900000	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	81.98691296	36.77082344	-7.98811563	171.96194154
B	-0.07596458	0.11893803	-0.36699567	0.21506650
C	-0.00196138	0.00128561	-0.00510716	0.00118439
D	0.00000719	0.00000480	-0.00000456	0.00001895

LOT	XL	XU	YI	AUC	UCP	DIF	PCT
1	0	20	20	112.5	65.9721	46.528	41.358
2	20	63	43	37.0	47.8069	-10.807	-29.208
3	63	88	25	28.6	48.7209	-20.121	-70.353
4	88	165	77	32.3	33.7090	-1.409	-4.362
5	165	298	133	23.4	26.2848	-2.885	-12.328
6	298	500	202	28.4	28.1859	0.214	0.754
7	500	601	101	27.3	23.1126	4.187	15.339
8	601	640	39	27.3	33.0014	-5.701	-20.884
9	640	702	62	35.4	27.1303	8.270	23.361
10	702	742	40	35.0	32.0063	2.994	8.553

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS — DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	14238328.87400000	3559582.21850000
RESIDUAL	0	0.00000000	0.00000000
UNCORRECTED TOTAL	4	14238328.87400000	
(CORRECTED TOTAL)	3	1830393.07390000	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	65.22365589	0	65.22365589	65.22365589
B	2.11000289	0	2.11000289	2.11000289
C	-0.16304234	0	-0.16304234	-0.16304234
D	0.00294647	0	0.00294647	0.00294647

B-58 (Continued)

LOT	XL	XU	YI	AUC	UCP	DIF	PCT
1	0	17	17	93.86	93.86	2.84217E-14	3.02810E-14
2	17	53	36	80.26	80.26	1.06581E-14	1.32795E-14
3	53	73	20	73.16	73.16	1.77636E-14	2.42804E-14
4	73	103	30	36.56	36.56	-2.13163E-14	-5.83049E-14

D.5.2 - Fighter Aircraft Programs

A-10

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	5178115.19993637	1294528.79998409
RESIDUAL	5	9102.18446363	1820.43689273
UNCORRECTED TOTAL	9	5187217.38440000	
(CORRECTED TOTAL)	8	1226666.30488889	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL	
			LOWER	UPPER
A	8.19618433	1.30837448	4.83294942	11.55941925
B	0.09690172	0.03944359	-0.00448979	0.19829324
C	-0.00140473	0.00072149	-0.00325935	0.00044990
D	0.00000462	0.00000368	-0.00000485	0.00001409

LOT	XL	XU	YI	AUC	UCP	DIF	PCT
1	0	22	22	12.37	9.4742	2.8958	23.410
2	22	75	53	9.16	9.3867	-0.2267	-2.475
3	75	95	20	8.20	11.2168	-3.0168	-36.790
4	95	195	100	8.20	8.3031	-0.1031	-1.257
5	195	339	144	7.82	7.7687	0.0513	0.656
6	339	483	144	7.59	7.7360	-0.1460	-1.924
7	483	627	144	7.82	7.7136	0.1064	1.361
8	627	687	60	10.18	9.9085	0.2715	2.667
9	687	707	20	13.64	13.0166	0.6234	4.570

F-100

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	11797789.25867287	2949447.31466822
RESIDUAL	1	37851.61032713	37851.61032713
UNCORRECTED TOTAL	5	11835640.86900000	
(CORRECTED TOTAL)	4	2086478.76652000	

F-100 (Continued)

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	6.60645440	3.07209339	-32.42756418	45.64047297
B	-0.00222124	0.72308484	-9.18973726	9.18529477
C	-0.00051310	0.00247406	-0.03194855	0.03092235
D	0.00000055	0.00000226	-0.00002816	0.00002926

LOT	XL	XU	YI	AUC	UCP	DIF	PCT
1	0	23	23	6.51	6.41617	0.09383	1.4414
2	23	568	545	3.45	3.47767	-0.02767	-0.8020
3	568	1161	593	3.08	3.09863	-0.01863	-0.6050
4	1161	1720	559	3.10	2.83341	0.26659	8.5997
5	1720	2277	557	2.50	2.72199	-0.22199	-8.8797

F-101

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	7056531.24291917	1764132.81072979
RESIDUAL	2	20328.60168083	10164.30084041
UNCORRECTED TOTAL	6	7076859.84460000	
(CORRECTED TOTAL)	5	2200718.46433334	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	24.94107297	8.30216716	-10.78066167	60.66280761
B	-0.26222776	0.10800983	-0.72696165	0.20250613
C	0.00019383	0.00069546	-0.00279853	0.00318619
D	-0.00000031	0.00000164	-0.00000738	0.00000675

LOT	XL	XU	YI	AUC	UCP	DIF	PCT
1	0	31	31	16.85	13.9021	2.9479	17.495
2	31	115	84	7.58	8.7689	-1.1889	-15.685
3	115	424	309	6.91	6.9178	-0.0078	-0.113
4	424	630	206	5.76	5.7069	0.0531	0.922
5	630	714	84	5.27	4.9586	0.3114	5.909
6	714	807	93	5.22	4.8485	0.3715	7.118

F-102

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	4462706.46600000	1115676.61650000
RESIDUAL	0	0.00000000	0.00000000
UNCORRECTED TOTAL	4	4462706.46600000	
(CORRECTED TOTAL)	3	1795723.51790000	

F-102 (Continued)

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	ASYMPTOTIC 95 % CONFIDENCE INTERVAL UPPER
A	32.57575434	0	32.57575434	32.57575434
B	-0.47034190	0	-0.47034190	-0.47034190
C	0.00057171	0	0.00057171	0.00057171
D	-0.00000072	0	-0.00000072	-0.00000072

LOT	XL	XU	YI	AUC	UCP	DIF	PCT
1	0	37	37	11.66	11.66	1.11022E-15	9.52164E-15
2	37	145	108	5.17	5.17	0	0
3	145	707	562	3.50	3.50	2.22045E-16	6.34413E-15
4	707	847	140	2.21	2.21	-2.22045E-16	-1.00473E-14

F-106

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	4765078.87330000	1191269.71832500
RESIDUAL	0	0.00000000	0.00000000
UNCORRECTED TOTAL	4	4765078.87330000	
(CORRECTED TOTAL)	3	480903.34267500	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	ASYMPTOTIC 95 % CONFIDENCE INTERVAL UPPER
A	92.09896942	0	92.09896942	92.09896942
B	-0.24316812	0	-0.24316812	-0.24316812
C	-0.00468075	0	-0.00468075	-0.00468075
D	0.00002071	0	0.00002071	0.00002071

LOT	XL	XU	YI	AUC	UCP	DIF	PCT
1	0	42	42	34.19	34.19	0	0
2	42	130	88	10.54	10.54	4.66294E-15	4.42404E-14
3	130	175	45	11.64	11.64	-3.99680E-15	-3.43368E-14
4	175	340	165	7.59	7.59	-2.22045E-16	-2.92549E-15

F-15A/B

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	10247277.62490481	2561819.40622620
RESIDUAL	2	506.96000415	253.48000207
UNCORRECTED TOTAL	6	10247784.58490896	
(CORRECTED TOTAL)	5	1585922.13232014	

F-15A/B (Contiuned)

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	35.74783092	1.40261979	29.71277875	41.78288308
B	-0.12422908	0.01730949	-0.19870662	-0.04975155
C	-0.00086324	0.00034041	-0.00232791	0.00060143
D	0.00000701	0.00000211	-0.00000205	0.00001607

LOT	XL	XU	YI	AUC	UCP	DIF	PCT
1	0	30	30	25.5970	25.6004	-0.00336	-0.01312
2	30	92	62	19.5560	19.3893	0.16673	0.85259
3	92	164	72	17.1838	17.3011	-0.11728	-0.68252
4	164	272	108	17.1260	17.2418	-0.11584	-0.67638
5	272	296	24	16.0210	16.1277	-0.10672	-0.66615
6	296	404	108	16.2720	16.1528	0.11919	0.73250

F-15C/D

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	8402003.16870197	2100500.79217549
RESIDUAL	4	17138.11767812	4284.52941953
UNCORRECTED TOTAL	8	8419141.28638009	
(CORRECTED TOTAL)	7	752329.31026303	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	2.56691360	2.42140710	-4.15589933	9.28972653
B	0.63222009	0.21807463	0.02675604	1.23768414
C	-0.01095123	0.00287455	-0.01893215	-0.00297031
D	0.00009899	0.00002987	0.00001607	0.00018192

LOT	XL	XU	YI	AUC	UCP	DIF	PCT
1	0	97	97	17.2499	16.9460	0.30394	1.7620
2	97	175	78	15.5880	16.5722	-0.98422	-6.3140
3	175	235	60	15.5080	14.9787	0.52930	3.4131
4	235	277	42	17.6650	17.5674	0.09763	0.5527
5	277	313	36	19.9430	20.6052	-0.66222	-3.3206
6	313	352	39	19.3080	20.2459	-0.93792	-4.8577
7	352	388	36	21.9540	22.3890	-0.43496	-1.9812
8	388	436	48	21.0170	19.2494	1.76758	8.4102

F-15E

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	14006867.36810101	3501716.84202525
RESIDUAL	2	25909.16853899	12954.58426949
UNCORRECTED TOTAL	6	14032776.53664000	
(CORRECTED TOTAL)	5	172346.38665600	

F-15E (Continued)

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	17.34342206	9.61325098	-24.01951293	58.70635706
B	0.39897991	1.04609204	-4.10204033	4.90000014
C	-0.00832174	0.02285300	-0.10665136	0.09000788
D	0.00004294	0.00013349	-0.00053142	0.00061731

F-16A/B

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	5500993.32062180	1375248.33015545
RESIDUAL	1	77043.41937820	77043.41937820
UNCORRECTED TOTAL	5	5578036.74000000	
(CORRECTED TOTAL)	4	338023.54800000	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	30.21539972	25.44599194	-293.10137390	353.53217333
B	-0.84750039	1.21825829	-16.32669020	14.63168942
C	0.00757614	0.01517466	-0.18523313	0.20038541
D	-0.00002395	0.00004991	-0.00065814	0.00061024

LOT	XL	XU	YI	AUC	UCP	DIF	PCT
1	0	105	105	10.14	10.1491	-0.00907	-0.089
2	105	250	145	7.74	8.2494	-0.50938	-6.581
3	250	425	175	8.04	6.8687	1.17125	14.568
4	425	605	180	5.05	5.9792	-0.92925	-18.401
5	605	725	120	5.13	4.7970	0.33305	6.492

F-16E

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	47902293.44676478	11975573.36169120
RESIDUAL	6	114552.17603520	19092.02933920
UNCORRECTED TOTAL	10	48016845.62279998	
(CORRECTED TOTAL)	9	1747028.76516001	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	21.00468435	7.63859418	2.31370424	39.69566445
B	-1.83323638	0.66711618	-3.46561204	-0.20086072
C	0.01997820	0.00701500	0.00281309	0.03714331
D	-0.00005519	0.00001902	-0.00010174	-0.00000864

F-16E (Continued)

LOT	XL	XU	YI	AUC	UCP	DIF	PCT
1	0	120	120	9.86	9.0525	0.8075	8.190
2	120	264	144	10.58	12.4008	-1.8208	-17.210
3	264	414	150	14.55	13.3250	1.2250	8.419
4	414	630	216	11.93	11.7611	0.1689	1.416
5	630	846	216	11.28	11.3850	-0.1050	-0.930
6	846	1062	216	11.02	11.1153	-0.0953	-0.865
7	1062	1278	216	10.88	10.9060	-0.0260	-0.239
8	1278	1494	216	10.69	10.7354	-0.0454	-0.425
9	1494	1710	216	10.61	10.5918	0.0182	0.171
10	1710	1926	216	10.54	10.4681	0.0719	0.683

D.5.3 - Electronics Programs

ARC-109V

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	66.72118584	16.68029646
RESIDUAL	1	0.02288789	0.02288789
UNCORRECTED TOTAL	5	66.74407373	
(CORRECTED TOTAL)	4	29.01018283	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	0.00695144	0.00632379	-0.07339862	0.08730150
B	0.79898305	0.45868382	-5.02905363	6.62701973
C	-0.00769389	0.00425680	-0.06178083	0.04639306
D	0.00002390	0.00001312	-0.00014282	0.00019061

LOT	XL	XU	YI	AUC	UCP	DIF	PCT
1	0	4	4	0.0487	0.0114073	0.0372927	76.5763
2	4	28	24	0.0393	0.0386921	0.0006079	1.5468
3	28	107	79	0.0285	0.0287412	-0.0002412	-0.8464
4	107	333	226	0.0313	0.0313015	-0.0000015	-0.0047
5	333	441	108	0.0303	0.0302283	0.0000717	0.2365

ARC-54

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	4664.89226556	1166.22306639
RESIDUAL	3	1.30867714	0.43622571
UNCORRECTED TOTAL	7	4666.20094270	
(CORRECTED TOTAL)	6	1109.40696153	

ARC-54 (Continued)

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	0.05034019	0.00770269	0.02582639	0.07485399
B	-0.19078158	0.03239693	-0.29388481	-0.08767835
C	0.00005074	0.00001645	-0.00000160	0.00010307
D	-0.00000001	0.00000000	-0.00000002	-0.00000000

LOT	XL	XU	YI	AUC	UCP	DIF	PCT
1	0	900	900	0.0210	0.0207921	0.00020787	0.9898
2	900	1753	853	0.0165	0.0164379	0.00006211	0.3764
3	1753	3134	1381	0.0164	0.0165016	-0.00010155	-0.6192
4	3134	4294	1160	0.0145	0.0149443	-0.00044431	-3.0642
5	4294	4594	300	0.0144	0.0114195	0.00298052	20.6980
6	4594	7697	3103	0.0139	0.0139687	-0.00006873	-0.4944
7	7697	10347	2650	0.0143	0.0141585	0.00014148	0.9894

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NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	27725.51534345	6931.37883586
RESIDUAL	6	16.44965266	2.74160878
UNCORRECTED TOTAL	10	27741.96499611	
(CORRECTED TOTAL)	9	14794.09415689	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	0.05257588	0.04076837	-0.04718081	0.15233257
B	0.18663976	0.10447231	-0.06899496	0.44227447
C	-0.00009177	0.00006635	-0.00025411	0.00007058
D	0.00000017	0.00000007	-0.00000000	0.00000035

LOT	XL	XU	YI	AUC	UCP	DIF	PCT
1	0	781	781	0.1866	0.186592	0.000008	0.0044
2	781	930	149	0.1744	0.173418	0.000982	0.5629
3	930	1217	287	0.1769	0.177601	-0.000701	-0.3960
4	1217	1358	141	0.1817	0.186882	-0.005182	-2.8522
5	1358	1450	92	0.1772	0.193293	-0.016093	-9.0816
6	1450	1585	135	0.2189	0.192782	0.026118	11.9314
7	1585	1693	108	0.1911	0.197398	-0.006298	-3.2955
8	1693	1851	158	0.1917	0.196755	-0.005055	-2.6369
9	1851	1887	36	0.2005	0.209566	-0.009066	-4.5215
10	1887	1923	36	0.2145	0.210301	0.004199	1.9577

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NON-LINEAR LEAST SQUARES SUMMARY STATISTICS			DEPENDENT VARIABLE TCA
SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	119.45353535	29.86338384
RESIDUAL	4	0.00246346	0.00061587
UNCORRECTED TOTAL	8	119.45599881	
(CORRECTED TOTAL)	7	64.18968336	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL	
			LOWER	UPPER
A	0.04039951	0.00138965	0.03654128	0.04425774
B	0.00054204	0.00350131	-0.00917902	0.01026310
C	-0.00045713	0.00009030	-0.00070783	-0.00020642
D	0.00000143	0.00000028	0.00000066	0.00000221

LOT	XL	XU	YI	AUC	UCP	DIF	PCT
1	0	152	152	0.0350	0.0349991	0.0000009	0.0025
2	152	402	250	0.0353	0.0353000	0.0000000	0.0001
3	402	483	81	0.0342	0.0342562	-0.0000562	-0.1644
4	483	541	58	0.0356	0.0354064	0.0001936	0.5439
5	541	567	26	0.0370	0.0378368	-0.0008368	-2.2616
6	567	575	8	0.0399	0.0396316	0.0002684	0.6726
7	575	583	8	0.0370	0.0396300	-0.0026300	-7.1080
8	583	594	11	0.0427	0.0393034	0.0033966	7.9545

ASN-99

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS			DEPENDENT VARIABLE TCA
SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	380.13529576	95.03382394
RESIDUAL	4	3.46831338	0.86707835
UNCORRECTED TOTAL	8	383.60360914	
(CORRECTED TOTAL)	7	61.21154176	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL	
			LOWER	UPPER
A	0.02974860	0.01211380	-0.00388424	0.06338144
B	0.14544010	0.06400285	-0.03225791	0.32313810
C	-0.00039215	0.00080328	-0.00262237	0.00183807
D	0.00000002	0.00000249	-0.00000690	0.00000693

LOT	XL	XU	YI	AUC	UCP	DIF	PCT
1	0	157	157	0.0464	0.0420081	0.004392	9.465
2	157	353	196	0.0404	0.0435694	-0.003169	-7.845
3	353	538	185	0.0413	0.0465268	-0.005227	-12.656
4	538	781	243	0.0433	0.0414229	0.001877	4.335
5	781	805	24	0.0570	0.0737689	-0.016769	-29.419
6	805	877	72	0.0624	0.0655365	-0.003137	-5.026
7	877	933	56	0.0635	0.0689739	-0.005474	-8.620
8	933	1050	117	0.0684	0.0592066	0.009193	13.441

CP-1035N

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	209.08912620	52.27228155
RESIDUAL	2	0.15902600	0.07951300
UNCORRECTED TOTAL	6	209.24815220	
(CORRECTED TOTAL)	5	41.36682739	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	0.13449959	0.03905091	-0.03352477	0.30252395
B	-0.34889695	0.21262784	-1.26377077	0.56597686
C	0.01150530	0.00527351	-0.01118505	0.03419565
D	-0.00009371	0.00003979	-0.00026491	0.00007748

LOT	XL	XU	YI	AUC	UCP	DIF	PCT
1	0	12	12	0.1248	0.099301	0.0254994	20.4322
2	12	38	26	0.0903	0.094039	-0.0037394	-4.1411
3	38	86	48	0.1236	0.127747	-0.0041471	-3.3553
4	86	134	48	0.1287	0.126801	0.0018988	1.4754
5	134	184	50	0.1310	0.129212	0.0017878	1.3648
6	184	264	80	0.1154	0.115452	-0.0000522	-0.0452

LANTIRN (Navigation Pod)

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	87339.21514009	21834.80378502
RESIDUAL	3	0.01575583	0.00525194
UNCORRECTED TOTAL	7	87339.23089592	
(CORRECTED TOTAL)	6	17386.82280392	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	1.82037795	0.00353749	1.80911989	1.83163600
B	-0.10914744	0.00142321	-0.11367681	-0.10461807
C	-0.00007912	0.00002104	-0.00014608	-0.00001217
D	0.00000028	0.00000009	-0.00000001	0.00000057

LOT	XL	XU	YI	AUC	UCP	DIF	PCT
1	0	4	4	1.7500	1.75633	-0.0063321	-0.36183
2	4	38	34	1.3199	1.31980	0.0000971	0.00735
3	38	176	138	1.0761	1.07585	0.0002500	0.02323
4	176	320	144	0.9679	0.96859	-0.0006931	-0.07161
5	320	464	144	0.9184	0.91798	0.0004193	0.04565
6	464	608	144	0.8854	0.88530	0.0001003	0.01132
7	608	724	116	0.8643	0.86439	-0.0000853	-0.00987

LANTIRN (Target Pod)

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	64803.82117107	16200.95529277
RESIDUAL	3	0.05960381	0.01986794
UNCORRECTED TOTAL	7	64803.88077488	
(CORRECTED TOTAL)	6	12795.42099227	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	1.52138356	0.00668058	1.50012260	1.54264452
B	-0.10124223	0.00307547	-0.11102992	-0.09145454
C	-0.00007882	0.00004347	-0.00021718	0.00005954
D	0.00000028	0.00000018	-0.00000029	0.00000086

LOT	XL	XU	YI	AUC	UCP	DIF	PCT
1	0	4	4	1.4375	1.47097	-0.033475	-2.3287
2	4	38	34	1.1286	1.12835	0.000251	0.0223
3	38	166	128	0.9375	0.93712	0.000382	0.0407
4	166	310	144	0.8490	0.84988	-0.000883	-0.1040
5	310	454	144	0.8081	0.80710	0.001003	0.1242
6	454	598	144	0.7795	0.77974	-0.000241	-0.0309
7	598	714	116	0.7619	0.76217	-0.000268	-0.0351

LANTIRN (Target Recognizer)

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	11937.74215771	2984.43553943
RESIDUAL	1	0.65430879	0.65430879
UNCORRECTED TOTAL	5	11938.39646650	
(CORRECTED TOTAL)	4	1483.53065817	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	0.65899898	0.05784850	-0.07602401	1.39402197
B	-0.24196931	0.12573548	-1.83956428	1.35562566
C	0.00215143	0.00273003	-0.03253633	0.03683918
D	-0.00000825	0.00001049	-0.00014158	0.00012507

LOT	XL	XU	YI	AUC	UCP	DIF	PCT
1	0	79	79	0.4383	0.438300	0.0000000	0.0000
2	79	271	192	0.3353	0.334241	0.0010585	0.3157
3	271	463	192	0.2975	0.300859	-0.0033594	-1.1292
4	463	655	192	0.2865	0.284188	0.0023115	0.8068
5	655	720	65	0.2693	0.269300	-0.0000000	-0.0000

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NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	2907.58501393	726.89625348
RESIDUAL	2	1.98896673	0.99448337
UNCORRECTED TOTAL	6	2909.57398066	
(CORRECTED TOTAL)	5	411.15312705	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL	
			LOWER	UPPER
A	0.76567110	0.09927355	0.33852679	1.19281542
B	-0.07193555	0.07971383	-0.41492027	0.27104917
C	-0.00199021	0.00189712	-0.01015295	0.00617254
D	0.00001364	0.00001482	-0.00005013	0.00007740

LOT	XL	XU	YI	AUC	UCP	DIF	PCT
1	0	14	14	0.5856	0.656291	-0.070691	-12.072
2	14	33	19	0.5862	0.551779	0.034421	5.872
3	33	102	69	0.4255	0.420183	0.005317	1.249
4	102	169	67	0.3828	0.378140	0.004660	1.217
5	169	250	81	0.3535	0.355637	-0.002137	-0.604
6	250	308	58	0.3355	0.345250	-0.009750	-2.906

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NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	560.38747529	140.09686882
RESIDUAL	1	0.24311995	0.24311995
UNCORRECTED TOTAL	5	560.63059524	
(CORRECTED TOTAL)	4	226.66710333	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL	
			LOWER	UPPER
A	0.08963964	0.08271532	-0.96134120	1.14062048
B	0.05458904	0.44356686	-5.58137144	5.69054951
C	-0.00092539	0.00410758	-0.05311624	0.05126546
D	0.00000332	0.00001313	-0.00016353	0.00017017

LOT	XL	XU	YI	AUC	UCP	DIF	PCT
1	0	8	8	0.1373	0.0944481	0.0428519	31.2104
2	8	39	31	0.1048	0.0980278	0.0067722	6.4620
3	39	116	77	0.0874	0.0908065	-0.0034065	-3.8976
4	116	332	216	0.0943	0.0943253	-0.0000253	-0.0268
5	332	440	108	0.0872	0.0861569	0.0010431	1.1962

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NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	297.18346817	74.29586704
RESIDUAL	2	3.69460551	1.84730275
UNCORRECTED TOTAL	6	300.87807368	
(CORRECTED TOTAL)	5	54.90298664	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	0.31828429	0.28369682	-0.90237802	1.53894661
B	-0.23920869	0.66889086	-3.11724540	2.63882802
C	0.00054164	0.01652537	-0.07056208	0.07164537
D	0.00000924	0.00012532	-0.00052996	0.00054843

LOT	XL	XU	YI	AUC	UCP	DIF	PCT
1	0	12	12	0.2338	0.233025	0.000775	0.331
2	12	38	26	0.1643	0.159444	0.004856	2.956
3	38	86	48	0.1524	0.145020	0.007380	4.842
4	86	134	48	0.0974	0.129368	-0.031968	-32.821
5	134	184	50	0.1441	0.122206	0.021894	15.193
6	184	264	80	0.1518	0.151981	-0.000181	-0.119

JTIDS

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	1570.85741369	392.71435342
RESIDUAL	1	0.18462452	0.18462452
UNCORRECTED TOTAL	5	1571.04203821	
(CORRECTED TOTAL)	4	40.25750283	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	0.63675886	0.08504955	-0.44388067	1.71739840
B	-0.00775266	0.34460119	-4.38625532	4.37075000
C	-0.00522658	0.01004136	-0.13281206	0.12235889
D	0.00003752	0.00007707	-0.00094178	0.00101681

LOT	XL	XU	YI	AUC	UCP	DIF	PCT
1	0	45	45	0.4068	0.404827	0.0019730	0.4850
2	45	121	76	0.2764	0.279460	-0.0030596	-1.1069
3	121	198	77	0.2466	0.246230	0.0003700	0.1500
4	198	270	72	0.2308	0.226575	0.0042250	1.8306
5	270	327	57	0.2205	0.223504	-0.0030042	-1.3624

D.5.4 - Helicopter Programs

HH-52

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS	DF	SUM OF SQUARES	DEPENDENT VARIABLE TCA MEAN SQUARE
SOURCE			
REGRESSION	4	3110.71607050	777.67901763
RESIDUAL	2	0.24595450	0.12297725
UNCORRECTED TOTAL	6	3110.96202500	
(CORRECTED TOTAL)	5	731.19918350	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	1.55181919	0.24147400	0.51282901	2.59080937
B	0.05227580	0.05301016	-0.17581103	0.28036263
C	-0.01940836	0.00419321	-0.03745049	-0.00136623
D	0.00063536	0.00012207	0.00011012	0.00116060

LOT	XL	XU	YI	AUC	UCP	DIF	PCT
1	0	28	28	1.577	1.57727	-0.000270	-0.0171
2	28	43	15	1.104	1.10288	0.001118	0.1013
3	43	60	17	1.085	1.07166	0.013344	1.2298
4	60	75	15	1.012	1.03638	-0.024376	-2.4087
5	75	87	12	1.041	1.04899	-0.007991	-0.7676
6	87	99	12	1.055	1.03613	0.018869	1.7886

CH-46

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS	DF	SUM OF SQUARES	DEPENDENT VARIABLE TCA MEAN SQUARE
SOURCE			
REGRESSION	4	356903.88698188	89225.97174547
RESIDUAL	4	2709.13217912	677.28304478
UNCORRECTED TOTAL	8	359613.01916100	
(CORRECTED TOTAL)	7	57764.44745087	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	5.85357030	1.96813461	0.38922652	11.31791407
B	-0.09672622	0.12810943	-0.45241022	0.25895777
C	-0.00091794	0.00149178	-0.00505973	0.00322386
D	0.00000224	0.00000543	-0.00001284	0.00001732

LOT	XL	XU	YI	AUC	UCP	DIF	PCT
1	0	14	14	7.541	4.92634	2.61466	34.673
2	14	50	36	3.898	3.80310	0.09490	2.435
3	50	110	60	2.766	3.13066	-0.36466	-13.183
4	110	195	85	2.419	2.64424	-0.22524	-9.311
5	195	394	199	1.986	1.98898	-0.00298	-0.150
6	394	486	92	2.236	2.18161	0.05439	2.432
7	486	576	90	2.370	2.12943	0.24057	10.151
8	576	624	48	2.547	2.45841	0.08859	3.478

H-53

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	618937.52299488	154734.38074872
RESIDUAL	4	141.24226512	35.31056628
UNCORRECTED TOTAL	8	619078.76526000	
(CORRECTED TOTAL)	7	355155.11827950	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	7.26742448	0.58824369	5.63422025	8.90062870
B	-0.10911617	0.01484775	-0.15033958	-0.06789275
C	-0.00077886	0.00083215	-0.00308924	0.00153152
D	0.00000481	0.00000496	-0.00000898	0.00001859

LOT	XL	XU	YI	AUC	UCP	DIF	PCT
1	0	10	10	6.752	6.29090	0.46110	6.829
2	10	141	131	4.264	4.27614	-0.01214	-0.285
3	141	281	140	3.762	3.75405	0.00795	0.211
4	281	293	12	3.382	3.73181	-0.34981	-10.343
5	293	323	30	3.341	3.48727	-0.14627	-4.378
6	323	331	8	3.154	3.73345	-0.57945	-18.372
7	331	361	30	3.685	3.43562	0.24938	6.767
8	361	367	6	3.947	3.71876	0.22824	5.783

CH-47

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	478702.14308786	119675.53577197
RESIDUAL	8	7158.39190214	894.79898777
UNCORRECTED TOTAL	12	485860.53499000	
(CORRECTED TOTAL)	11	132801.70813367	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	5.59747813	1.72430200	1.62119224	9.57376402
B	-0.03646440	0.08402986	-0.23023946	0.15731067
C	-0.00150825	0.00114077	-0.00413889	0.00112239
D	0.00000532	0.00000547	-0.00000730	0.00001794

LOT	XL	XU	YI	AUC	UCP	DIF	PCT
1	0	18	18	6.181	4.98943	1.19157	19.278
2	18	42	24	5.226	4.42688	0.79912	15.291
3	42	66	24	4.559	4.24320	0.31580	6.927
4	66	126	60	3.459	3.42903	0.02997	0.866
5	126	198	72	2.760	3.08258	-0.32258	-11.688
6	198	358	160	2.307	2.52944	-0.22244	-9.642

CH-47 (Continued)

LOT	XL	XU	YI	AUC	UCP	DIF	PCT
7	358	442	84	2.313	2.63794	-0.32494	-14.048
8	442	585	143	2.695	2.28948	0.40552	15.047
9	585	630	45	3.463	3.07309	0.38991	11.259
10	630	666	36	3.085	3.25241	-0.16741	-5.427
11	666	678	12	3.671	3.94356	-0.27256	-7.425
12	678	690	12	3.852	3.93981	-0.08781	-2.280

H-54

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	21059.21219386	5264.80304847
RESIDUAL	1	69.57671414	69.57671414
UNCORRECTED TOTAL	5	21128.78890800	
(CORRECTED TOTAL)	4	3891.65021280	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	4.43801970	1.16556439	-10.37164148	19.24768088
B	-0.10219602	0.17269144	-2.29641346	2.09202143
C	0.00793836	0.01434834	-0.17437160	0.19024833
D	-0.00028744	0.00033079	-0.00449047	0.00391558

LOT	XL	XU	YI	AUC	UCP	DIF	PCT
1	0	6	6	5.248	4.22498	1.02302	19.4935
2	6	30	24	3.388	3.57594	-0.18794	-5.5473
3	30	60	30	2.801	2.78882	0.01218	0.4349
4	60	83	23	3.402	3.26916	0.13284	3.9048
5	83	89	6	3.083	3.32368	-0.24068	-7.8068

HH-60D

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	123892.22000000	30973.05500000
RESIDUAL	0	0.00000000	0.00000000
UNCORRECTED TOTAL	4	123892.22000000	
(CORRECTED TOTAL)	3	24351.97000000	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	8.61801794	0	8.61801794	8.61801794
B	-0.46349738	0	-0.46349738	-0.46349738
C	0.02604455	0	0.02604455	0.02604455
D	-0.00041999	0	-0.00041999	-0.00041999

HH-60D (Continued)

LOT	XL	XU	YI	AUC	UCP	DIF	PCT
1	0	3	3	9.2	9.2	-4.44089E-16	-4.82706E-15
2	3	28	25	7.1	7.1	2.22045E-16	3.12739E-15
3	28	63	35	6.7	6.7	1.99840E-15	2.98269E-14
4	63	92	29	6.6	6.6	-6.66134E-16	-1.00929E-14

SH-3

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	72776.02616690	18194.00654172
RESIDUAL	5	200.28737510	40.05747502
UNCORRECTED TOTAL	9	72976.31354200	
(CORRECTED TOTAL)	8	13013.69066156	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	4.49846634	0.52797233	3.14128994	5.85564275
B	-0.13867967	0.06431298	-0.30399904	0.02663970
C	-0.00158918	0.00232086	-0.00755506	0.00437671
D	0.00002174	0.00002213	-0.00003514	0.00007862

LOT	XL	XU	YI	AUC	UCP	DIF	PCT
1	0	20	20	3.327	3.30549	0.02151	0.647
2	20	69	49	2.480	2.43693	0.04307	1.737
3	69	140	71	2.319	2.33298	-0.01398	-0.603
4	140	185	45	1.811	1.93177	-0.12077	-6.669
5	185	221	36	1.870	1.84575	0.02425	1.297
6	221	257	36	1.589	1.79577	-0.20677	-13.012
7	257	287	30	1.703	1.76623	-0.06323	-3.713
8	287	335	48	1.930	1.74646	0.18354	9.510
9	335	350	15	2.144	1.79284	0.35116	16.379

D.5.5 - Tactical Armaments Programs

LLLGB

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	220660521316.63494	55165130329.15874
RESIDUAL	6	5896176.36496	982696.06083
UNCORRECTED TOTAL	10	220666417492.99991	
(CORRECTED TOTAL)	9	31936246324.90007	

LLLGB (Continued)

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	77.80725620	4.00285670	68.01261163	87.60190078
B	-0.16213964	0.00788642	-0.18143704	-0.14284225
C	-0.00000073	0.00000055	-0.00000207	0.00000060
D	0.00000000	0.00000000	-0.00000000	0.00000000

LOT	XL	XU	YI	AUC	UCP	DIF	PCT
1	0	1600	1600	27.5	27.8857	-0.38575	-1.4027
2	1600	4550	2950	20.6	21.0030	-0.40303	-1.9564
3	4550	8290	3740	18.9	18.4486	0.45136	2.3881
4	8290	17270	8980	16.2	16.1963	0.00372	0.0229
5	17270	26890	9620	14.7	14.7299	-0.02992	-0.2035
6	26890	41290	14400	13.7	13.6675	0.03248	0.2371
7	41290	56890	15600	12.9	12.8731	0.02694	0.2089
8	56890	72490	15600	12.3	12.2902	0.00981	0.0798
9	72490	88090	15600	11.8	11.8536	-0.05363	-0.4545
10	88090	100000	11910	11.5	11.5186	-0.01863	-0.1620

CEM

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	1106940398140.1410	276735099535.0353
RESIDUAL	4	172800754.6109	43200188.6527
UNCORRECTED TOTAL	8	1107113198894.7521	
(CORRECTED TOTAL)	7	367517125638.9579	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	182.02926806	43.07207680	62.44362934	301.61490679
B	-0.27084938	0.03182090	-0.35919716	-0.18250160
C	0.00000207	0.00000056	0.00000051	0.00000363
D	-0.00000000	0.00000000	-0.00000000	-0.00000000

LOT	XL	XU	YI	AUC	UCP	DIF	PCT
1	0	172	172	69.24	62.0034	7.2366	10.4514
2	172	1432	1260	30.38	31.7083	-1.3283	-4.3723
3	1432	7557	6125	19.88	21.2310	-1.3510	-6.7958
4	7557	21777	14220	17.65	17.3230	0.3270	1.8530
5	21777	50227	28450	16.19	15.9891	0.2009	1.2409
6	50227	85247	35020	14.01	14.1980	-0.1880	-1.3418
7	85247	134157	48910	12.58	12.5505	0.0295	0.2343
8	134157	171666	37509	11.81	11.8237	-0.0137	-0.1158

GBU-15

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	40005778926.482194	10001444731.620548
RESIDUAL	5	74507310.517794	14901462.103559
UNCORRECTED TOTAL	9	40080286236.999989	
(CORRECTED TOTAL)	8	10225399631.555555	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	364.74732042	113.26450095	73.59587163	655.89876922
B	-0.10490216	0.10135108	-0.36542963	0.15562531
C	-0.00033249	0.00036509	-0.00127098	0.00060600
D	0.00000053	0.00000040	-0.00000050	0.00000157

LOT	XL	XU	YI	AUC	UCP	DIF	PCT
1	0	40	40	197.5	268.041	-70.541	-35.717
2	40	105	65	200.0	215.274	-15.274	-7.637
3	105	445	340	143.9	153.507	-9.607	-6.676
4	445	695	250	148.3	136.796	11.504	7.757
5	695	1015	320	130.8	126.661	4.139	3.164
6	1015	1615	600	171.8	162.314	9.486	5.521
7	1615	2215	600	153.9	155.479	-1.579	-1.026
8	2215	2815	600	148.3	150.734	-2.434	-1.641
9	2815	3415	600	142.0	147.122	-5.122	-3.607

D.5.5 - Tactical Missile Programs

AMRAAM

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	3264285.69115134	816071.42278783
RESIDUAL	6	1634.83770166	272.47295028
UNCORRECTED TOTAL	10	3265920.52885300	
(CORRECTED TOTAL)	9	185036.68624890	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	4.78302212	0.76191388	2.91868466	6.64735957
B	-0.34508824	0.03598195	-0.43313297	-0.25704351
C	-0.00000095	0.00001230	-0.00003104	0.00002914
D	0.00000000	0.00000000	-0.00000000	0.00000001

AMRAAM (Continued)

LOT	XL	XU	YI	AUC	UCP	DIF	PCT
1	0	194	194	1.223	1.18510	0.0379020	3.0991
2	194	1251	1057	0.512	0.51839	-0.0063858	-1.2472
3	1251	3215	1964	0.342	0.33932	0.0026820	0.7842
4	3215	6211	2996	0.257	0.26302	-0.0060169	-2.3412
5	6211	9111	2900	0.232	0.22105	0.0109459	4.7180
6	9111	12011	2900	0.194	0.19767	-0.0036746	-1.8941
7	12011	14911	2900	0.182	0.18174	0.0002596	0.1426
8	14911	17911	3000	0.170	0.17000	-0.0000010	-0.0006
9	17911	20911	3000	0.158	0.16043	-0.0024344	-1.5408
10	20911	24674	3763	0.155	0.15428	0.0007243	0.4673

HARM

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	1580675.11944221	395168.77986055
RESIDUAL	7	760.19165078	108.59880725
UNCORRECTED TOTAL	11	1581435.31109300	
(CORRECTED TOTAL)	10	341122.41543764	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	1.16047134	0.13799627	0.83415940	1.48678327
B	-0.16885054	0.02017346	-0.21655358	-0.12114750
C	-0.00002352	0.00000845	-0.00004349	-0.00000355
D	0.00000000	0.00000000	0.00000000	0.00000001

LOT	XL	XU	YI	AUC	UCP	DIF	PCT
1	0	80	80	0.809	0.662313	0.146687	18.1319
2	80	316	236	0.517	0.468504	0.048496	9.3803
3	316	712	396	0.400	0.385501	0.014499	3.6247
4	712	1399	687	0.314	0.326429	-0.012429	-3.9582
5	1399	3144	1745	0.249	0.257937	-0.008937	-3.5893
6	3144	5612	2468	0.223	0.221599	0.001401	0.6283
7	5612	7731	2119	0.208	0.204461	0.003539	1.7016
8	7731	9863	2132	0.197	0.193448	0.003552	1.8030
9	9863	12863	3000	0.184	0.185355	-0.001355	-0.7362
10	12863	15863	3000	0.177	0.176969	0.000031	0.0177
11	15863	16961	1098	0.186	0.185476	0.000524	0.2815

IIR-MAVERICK

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	2027565.81262027	506891.45315507
RESIDUAL	5	3898.29268873	779.65853775
UNCORRECTED TOTAL	9	2031464.10530900	
(CORRECTED TOTAL)	8	458719.86902800	

IIR-MAVERICK (Continued)

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	0.22697731	0.07748923	0.02778779	0.42616683
B	-0.09771240	0.05409737	-0.23677211	0.04134731
C	-0.00000600	0.00000636	-0.00002234	0.00001034
D	0.00000000	0.00000000	-0.00000000	0.00000000

LOT	XL	XU	YI	AUC	UCP	DIF	PCT
1	0	200	200	0.309	0.149153	0.159847	51.730
2	200	1100	900	0.135	0.117816	0.017184	12.729
3	1100	3700	2600	0.083	0.095774	-0.012774	-15.390
4	3700	9429	5729	0.082	0.076429	0.005571	6.794
5	9429	18429	9000	0.062	0.064170	-0.002170	-3.500
6	18429	30429	12000	0.057	0.057606	-0.000606	-1.063
7	30429	42429	12000	0.055	0.054514	0.000486	0.884
8	42429	54429	12000	0.053	0.052429	0.000571	1.077
9	54429	60664	6235	0.057	0.057054	-0.000054	-0.094

AIM-7FR

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	114813.07648922	28703.26912230
RESIDUAL	4	338.50841078	84.62710270
UNCORRECTED TOTAL	8	115151.58490000	
(CORRECTED TOTAL)	7	6543.29278750	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	2.07162609	0.77717890	-0.08613926	4.22939145
B	-0.31733207	0.10262419	-0.60225865	-0.03240549
C	-0.00007502	0.00010673	-0.00037135	0.00022131
D	0.00000004	0.00000005	-0.00000010	0.00000017

LOT	XL	XU	YI	AUC	UCP	DIF	PCT
1	0	100	100	0.741	0.688209	0.052791	7.124
2	100	325	225	0.378	0.357066	0.020934	5.538
3	325	925	600	0.199	0.222858	-0.023858	-11.989
4	925	1725	800	0.169	0.163407	0.005593	3.310
5	1725	2825	1100	0.134	0.132479	0.001521	1.135
6	2825	4225	1400	0.116	0.117352	-0.001352	-1.165
7	4225	5125	900	0.111	0.102612	0.008388	7.557
8	5125	6269	1144	0.095	0.095342	-0.000342	-0.360

NON-LINEAR LEAST SQUARES SUMMARY STATISTICS DEPENDENT VARIABLE TCA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	4	28547.66717889	7136.91679472
RESIDUAL	2	73.49084611	36.74542306
UNCORRECTED TOTAL	6	28621.15802500	
(CORRECTED TOTAL)	5	7732.20792083	

PARAMETER	ESTIMATE	ASYMPTOTIC STD. ERROR	ASYMPTOTIC 95 % CONFIDENCE INTERVAL LOWER	UPPER
A	2.41735096	0.81806471	-1.10253606	5.93723798
B	-0.45714548	0.08126658	-0.80681118	-0.10747977
C	0.00005323	0.00008811	-0.00032587	0.00043233
D	-0.00000003	0.00000005	-0.00000023	0.00000017

LOT	XL	XU	YI	AUC	UCP	DIF	PCT
1	0	15	15	1.551	1.29209	0.258906	16.693
2	15	85	70	0.379	0.43859	-0.059594	-15.724
3	85	295	210	0.228	0.24012	-0.012116	-5.314
4	295	505	210	0.195	0.16706	0.027937	14.327
5	505	1255	750	0.130	0.13044	-0.000443	-0.340
6	1255	2565	1310	0.090	0.08995	0.000050	0.056

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The need to make decisions concerning production rate changes in today's cost conscious environment requires that accurate estimates be made of their impact on cost. The Analytic Sciences Corporation (TASC) developed a model for Air Force Systems Command (AFSC) for this purpose. This model, along with two alternative formulations of the production rate problem is the subject of this investigation.

Based on this analysis it has been determined that the current AFSC model is capable of providing more accurate estimates than the standard unit learning curve model which it is derived from. The first alternative formulation, which includes an additional variable to account for changes in production rate, was shown to consistently provide more accurate estimates than the current model. Since it is based on the current formulation, it can easily be incorporated into the present AFSC model. It is recommended that Systems Command do so. The second formulation, which is based on the unit learning curve model with the exponent expressed as a function of production rate, also provides more accurate estimates than the current formulation though, not as consistently. There is evidence which suggests that this formulation is capable of providing more accurate estimates than the first alternative for certain types of programs. It is recommended that this be further investigated.

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